The EDISON ELECTRIC INSTITUTE BULLETIN

April
1954

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EEI Convention Preparations

A Challenge to Engineers
Walter H. Sammis

Thoughts on Tomorrow
Frank M. Tait

Employee Selection
E. R. Eberle

Outdoor Generating Stations
M. H. Long and J. S. Newbold

Post-War Growth and Planning for Long Island Lighting Co.
William Welch, Jr., and Arthur C. Sugden

Published Monthly by Edison Electric Institute

ELECTRICAL RESEARCH STATISTICS
THE ELECTRIC LIGHT AND POWER INDUSTRY

Current Statistical Data Covering 100 Per Cent of Industry

January, 1953-1954

SOURCE AND DISPOSAL OF ENERGY—MONTH OF JANUARY

	1954	1953	%
GENERATION* (Net)			
By Fuel Burning Plants	30,524,195,000	27,401,502,000	+11.4
By Water Power Plants	8,898,960,000	9,261,324,000	− 3.9
Total Generation	**39,423,155,000**	**36,662,826,000**	**+ 7.5**
Add—Net Imports Over International Boundaries	36,448,000	151,842,000	−76.0
Less—Company Use	152,857,000	143,001,000	+ 6.9
Less—Energy Used by Producer	692,307,000	563,262,000	+22.9
Net Energy for Distribution	**38,614,439,000**	**36,108,405,000**	**+ 6.9**
Lost and Unaccounted for	4,378,990,000	4,180,279,000	+ 4.8
Sales to Ultimate Customers	**34,235,449,000**	**31,928,126,000**	**+ 7.2**

CLASSIFICATION OF SALES

NUMBER OF CUSTOMERS—As of January 31			
Residential or Domestic	42,084,577	40,771,340	+ 3.2
Rural (Distinct Rural Rates)	1,619,061	1,608,736	+ 0.6
Commercial or Industrial:			
Small Light and Power	5,871,748	5,642,966	+ 4.1
Large Light and Power	271,398	262,975	+ 3.2
Other Customers	160,170	156,666	+ 2.2
Total Ultimate Customers	**50,006,954**	**48,442,683**	**+ 3.2**
KILOWATTHOUR SALES—During Month of January			
Residential or Domestic	10,163,380,000	9,158,258,000	+11.0
Rural (Distinct Rural Rates)	612,300,000	522,869,000	+17.1
Commercial or Industrial:			
Small Light and Power	6,103,538,000	5,665,861,000	+ 7.7
Large Light and Power	15,667,932,000	14,970,524,000	+ 4.7
Street and Highway Lighting	395,073,000	366,784,000	+ 7.7
Other Public Authorities	786,753,000	730,276,000	+ 7.7
Railways and Railroads:			
Street and Interurban Railways	266,961,000	269,329,000	− 0.9
Electrified Railroads	192,209,000	204,751,000	− 6.1
Interdepartmental	47,303,000	39,474,000	+19.8
Total to Ultimate Customers	**34,235,449,000**	**31,928,126,000**	**+ 7.2**
Revenue from Ultimate Customers	**$611,624,200**	**$574,587,100**	**+ 6.4**

RESIDENTIAL OR DOMESTIC SERVICE

AVERAGE CUSTOMER DATA—For 12 months ended January 31			
Kilowatthours per Customer	2,363	2,183	+ 8.2
Average Annual Bill	$64.75	$60.47	+ 7.1
Revenue per Kilowatthour	2.74¢	2.77¢	− 1.1

* By Courtesy of the Federal Power Commission.

THE EDISON ELECTRIC INSTITUTE BULLETIN is published monthly by the Edison Electric Institute, an association of electric light and power companies in the United States and its territorial possessions. Its affiliate members consist of members of the Canadian Electrical Association.

The objectives of the Edison Electric Institute are:

The advancement in the public service of the art of producing, transmitting, and distributing electricity and the promotion of scientific research in such field.

The ascertainment and making available to the members and the public of factual information, data, and statistics relating to the electric industry.

To aid its operating company members to generate and sell electric energy at the lowest possible price commensurate with safe and adequate service, giving due regard to the interests of consumer, investor, and employee.

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The EDISON ELECTRIC INSTITUTE BULLETIN

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CONVENTIONS AND MEETINGS

1954

APRIL

5- 6 14th Annual Young Men's Utility Conference, sponsored by Indiana Electric Association, Gary Hotel, Gary, Ind.

5- 8 20th Annual EEI Sales Conference, Edgewater Beach Hotel, Chicago, Ill.

7- 8 Pacific Coast Electrical Association, Administration Services Section, Hotel Claremont, Berkeley, Calif.

7- 9 Missouri Valley Electric Association Engineering Conference, President Hotel, Kansas City, Mo.

8- 9 IES Southern Regional Conference, Roosevelt Hotel, New Orleans, La.

11-14 IES Southwestern Regional Conference, Rice Hotel, Houston, Tex.

12-14 EEI-AGA Accounting Conference, Hotel Statler, Boston, Mass.

13 EEI Area Development Committee, Hotel Roosevelt, New York, N. Y.

15 EEI Industrial Relations Committee, Netherland Plaza Hotel, Cincinnati, Ohio.

15-16 IES Inter-Mountain Regional Conference, Denver, Colo.

15-17 Northwest Electric Light and Power Association Engineering and Operation Section Meeting, Olympic Hotel, Seattle, Wash.

19-20 IES South Pacific Coast Regional Meeting, Museum of Art, San Francisco, Calif.

20-23 13th Annual Conference of Public Utility Fleet Operators, sponsored jointly by EEI Transportation Committee and AGA Automotive and Mobile Equipment Committee, Mount Royal Hotel, Montreal, Que.

22-23 IES Pacific Northwest Regional Meeting, Benjamin Franklin Hotel, Seattle, Wash.

26-27 NCEA Accounting Meeting, Dyckman Hotel, Minneapolis, Minn.

28 EEI Financing and Investor Relations Committee, EEI Headquarters, New York, N. Y.

28-30 IES Canadian Regional Meeting, King Edward Hotel, Toronto, Ont.

29 NAEC Annual Meeting, Mayflower Hotel, Washington, D. C.

MAY

2- 4 Rocky Mountain Electrical League Annual Spring Conference, Shirley Savoy Hotel, Denver, Colo.

3- 4 IES Great Lakes Regional Meeting, Sheraton Cadillac Hotel, Detroit, Mich.

3- 5 EEI Engineering Committees, Edgewater Beach Hotel, Chicago, Ill.

3-4 Meter and Service; Prime Movers; Electrical Equipment.

4-5 Hydraulic Power; Transmission and Distribution.

3- 5 EEI Purchasing and Stores Committee, Hotel Roosevelt, New York, N. Y.

5- 7 AIEE Northeastern District Meeting, Van Curler Hotel, Schenectady, N. Y.

10-12 Northwest Electric Light and Power Association Business Development Section Meeting, Hotel Boise, Boise, Ida.

1954

MAY

11 EEI Commercial Electric Cooking Conference, Sheraton Hotel, Chicago, Ill.

13-14 PUAA Annual Convention, Hotel Statler, Boston, Mass.

13-14 PEA Transmission and Distribution Committee Meeting, Fort Bedford Inn, Bedford, Pa.

17-18 PEA Prime Movers Committee Spring Meeting, Castleton Hotel, New Castle, Pa.

18 IES Northeastern Regional Conference, Hotel Bond, Hartford, Conn.

19-21 Pacific Coast Electrical Association Annual Convention, Hotel Del Coronado, Coronado, Calif.

20-21 Northwest Electric Light and Power Association Accounting and Business Practice Section Meeting, Davenport Hotel, Spokane, Wash.

24-25 PEA Electrical Equipment Committee, Lord Baltimore Hotel, Baltimore, Md.

JUNE

1- 3 EEI ANNUAL CONVENTION, Atlantic City, N. J.

3- 5 Controllers Institute of America Western Conference, Empress Hotel, Victoria, B. C.

14 NARUC Executive Committee, Washington, D. C.

14-19 ASCE Convention, Chalfonte Haddon Hall, Atlantic City, N. J.

17-19 IES Midwestern Regional Meeting, Hotel Jefferson, St. Louis, Mo.

24-26 CEA Annual Convention, Murray Bay, Quebec, Que.

27-30 Michigan Electrical Association Annual Convention, Grand Hotel, Mackinac Island, Mich.

JULY

1- 3 EEI Accident Prevention Committee, Mark Hopkins Hotel, San Francisco, Calif.

12-13 EEI Industrial Relations Committee Joint Meeting with Personnel Section of Northwest Electric Light and Power Association, Hotel Multnomah, Portland, Ore.

SEPTEMBER

14-17 EEI-AGA Accounting Division Organization Meeting, Hotel Cleveland, Cleveland, Ohio.

16-18 36th Annual Meeting of Public Utilities Association of Virginias, The Greenbrier, White Sulphur Springs, W. Va.

27-29 EEI Industrial Relations Committee, Round-Table Conference, Palmer House, Chicago, Ill.

OCTOBER

6- 8 Indiana Electric Association Annual Convention, French Lick Springs Hotel, French Lick, Ind.

10-13 Controllers Institute of America, Annual Meeting, Edgewater Beach Hotel, Chicago, Ill.

18-22 ASCE Annual Convention, Hotel Statler, New York, N. Y.

28-29 PIP Workshop Conference, Chase Park Plaza Hotel, St. Louis, Mo.

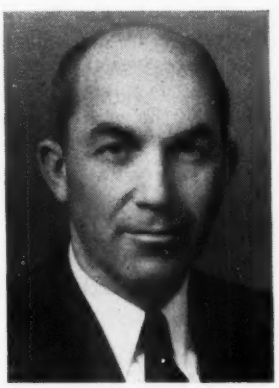
The EDISON ELECTRIC INSTITUTE
BULLETIN

Annual EEI Convention to Commemorate Jubilee with Program Geared to Future

MEETING during the year-long observance of Light's Diamond Jubilee, the 22nd Annual EEI Convention, to be held in Atlantic City, June 1-3, will commemorate the electric industry's 75 years of service to the nation in a program designed to help industry executives chart a sound course for the unlimited opportunities ahead.

The industry has much to celebrate this year—75 years of achievement, the attainment of fifty million customers and one hundred million kilowatts of capacity—and the convention will undoubtedly reflect the stimulation occasioned by these milestones. Homage will be paid to Edison and his great work, and Atlantic City will be festive with Jubilee lighting.

But, more important, the meeting will be a time for serious cogitation, for an appreciation of what remains to be done so that the industry's great potential for further public service can be fulfilled.



B. L. ENGLAND
Chairman of the Convention Program Committee

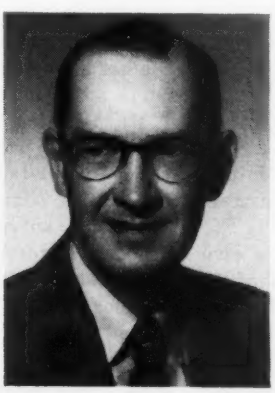
In a program geared to the future, the convention's five general sessions will deal with, among other things, load building and advances in sales and engineering techniques; improving industry operations, including customer relations and area development; finance, including administration money policy, regulation, and the future money market; power marketing, atomic energy progress, and prospects for use of atomic energy in the generation of electric power. There will also be special Jubilee presentations.

The Convention Program Committee is now completing arrangements for the meeting. Under the chairmanship of B. L. England, President of Atlantic City Electric Co., the committee is composed of J. M. Bell, President of New York State Electric and Gas Corp.; P. H. Powers, President of West Penn Power Co.; H. B. Sargent, President of Arizona Public Service Co.; and W. O. Turner, President of Louisiana Power and Light Co.

To address the convention, the committee has secured nationally-known speakers of wide experience in business, professional, and governmental circles. A list of the speakers and a description of the program will appear in next month's BULLETIN.

J. M. BELL

P. H. POWERS



H. B. SARGENT

W. O. TURNER

Members of the Convention Program Committee

Because Monday is a holiday, the first of the general sessions will begin on Tuesday, June 1, at 10 am. The second general session will meet on Tuesday afternoon; the third and fourth on Wednesday morning and afternoon; and the fifth on Thursday morning. All of the sessions will be held in the Ballroom of Atlantic City's Convention Hall.

Delegates and guests are urged to register at their first opportunity. For the convenience of those who arrive in Atlantic City early, registration will begin on Monday and continue throughout the convention. There will be a registration fee of $10.00.

Admission to business sessions and social functions will be by convention badges for the gentlemen and pins for the ladies. Pins and badges will be obtainable only upon registration.

Functions and Attractions

Convention-goers will have opportunity to meet socially at the President's Cocktail Party, the first of several social functions planned for the meeting. The party will take place on Tuesday evening from 5:00 to 7:00 in the Vernon Room and Solarium of Hotel Haddon Hall. Music will be provided for dancing.

On Wednesday noon the Institute will welcome the ladies to a luncheon in Trimble Hall of the Claridge Hotel A fashion show will be presented, and there will be a nationally-known guest speaker.

A program of special entertainment, beginning with presentation of the Charles A. Coffin Award at 8:45 pm, will be held at the Warner Theatre on the Boardwalk. At 9:00 pm Westinghouse Electric Corp. will present the Robin Hood Dell Orchestra, under the baton of Percy Faith, whose recordings of popular and light classical music have become national favorites. Featured entertainer will be Victor Borge, pianist, humorist, and radio-TV personality, who is presently appearing in his own show on Broadway. Actress Betty Furness, of motion picture and TV fame, will act as mistress of ceremonies.

The convention will have its own daily newspaper, to be published on Tuesday, Wednesday, and Thursday through the courtesy of *Electrical World*. Official notices, reports on the general sessions, and a roster of convention registrants will be featured.

Atlantic City's 100th anniversary is coincidental with Light's Diamond Jubilee and has a Jubilee theme. Although the city's centennial will be celebrated throughout 1954, the observance will be concentrated in the 100 days following the start of the convention on June 1.

Special Jubilee lighting installations will enhance the boardwalk and the avenues, and at night 14 searchlights will send their beams into the sky. Lighting displays have been engineered for commercial buildings, and old Absecon Lighthouse has been restored and will be illuminated after dark.

On the boardwalk each afternoon and evening, a parade of ten animated floats, which will be uniquely lit at night, will depict eras of Atlantic City history. The buildings of Atlantic City Electric Co., the convention's host, will also be specially illuminated.

In addition, the start of the convention will mark the official opening of the new Garden Pier, which has been rebuilt as a civic center with solariums, landscaped promenades, and an amphitheatre. There will be nightly concerts in the amphitheatre, featuring bands, organ music, choruses, and barber shop quartets. The concerts will be followed by brilliant firework displays. At the ocean end of the pier there will be a spectacularly illuminated fountain, 100-ft long, synchronizing light, water, and music.

Convention attendance is expected to be large, and it is suggested that hotel reservations be secured as soon as possible. Because of the Memorial Day week-end crowds, it is particularly important that delegates and guests have confirmation of their reservations before arriving in Atlantic City. The Official Application for Hotel Reservations may be obtained upon request to the Institute, and additional information on housing may be secured from M. H. Yarnall, Housing Bureau, 16 Central Pier, Atlantic City, N. J.

David O. Selznick to Produce Multi-Network Light's Diamond Jubilee Television Program

ARRANGEMENTS have been completed for Motion Picture Producer David O. Selznick to make his television debut by producing an unprecedented, two-hour, multi-network Light's Diamond Jubilee television program on Sunday, October 24, 1954.

The Jubilee show will be aimed at the largest audience ever to witness any show in any medium in the history of entertainment as a result of the purchase of coast-to-coast time simultaneously on three networks. The facilities of CBS, NBC, and a third network will be pooled to present the program. Details of this coverage are not yet complete, but plans call for the use of some new stations that will begin operations prior to the show.

Mr. Selznick enters the television field with a background of some 30 years of outstanding motion picture production. His "Gone With the Wind" has amassed the biggest gross in movie history and has proven to be the most successful and honored of all films. Others of his productions include "Rebecca," "David Copperfield," "A Tale of Two Cities," "Duel in the Sun," "A Star Is Born," "Tom Sawyer," "Dinner at Eight," "Anna Karenina" (Greta Garbo version), "Spellbound," "Since You Went Away," and "Viva Villa."

Throughout his career, Mr. Selznick has been identified with unusual films. He has twice won the Oscar of the Motion Picture Academy of Arts and Sciences for the best producer of the year and has received the Irving Thalberg Award given by the academy for "the most consistent high quality of production." Among the scores of stars introduced or developed under his personal guidance are Vivian Leigh, Ingrid Bergman, Gregory Peck, Jennifer Jones, Joan Fontaine, and Katherine Hepburn.

Mr. Selznick stated that, although it is too soon to say anything specific about it, the Jubilee program will not be a variety show. He sees it as one with dramatic unity and format that will present an interpretation of the spirit and meaning of American life, both in the past 75 years and in the future, with the significance of electrical living an integral part. He said that he was as yet uncertain whether the show would be produced in Hollywood or New York, or perhaps partially in both centers. He stated further that he hopes to introduce new techniques not yet utilized on TV.

The Power Industry—A Challenge to Engineers

Walter H. Sammis
President, Ohio Edison Company, and
President, Edison Electric Institute

An address before the American Power Conference, Chicago, Ill., March 24, 1954

THIS year the world will celebrate the 75th anniversary of Edison's incandescent lamp—an invention that started a chain reaction in the harnessing of electric energy that has had a profound impact on the social and economic life of the world. The influence of this development is so apparent and its history so marked by the integration of so many technical achievements that we who have spent our lives in the business are prone to take for granted the potentialities of the future and tend to overlook the thoughts in the minds of those on the threshold of their careers who may be asking the questions: Is there any real future in a 75-year old industry? Have all the engineering problems been worked out? Has all hope of new discoveries and further developments ended? Has the job settled down to a routine business?

Servant of the People

Electricity is truly the servant of the American people. It is a bright, cheerful, and instantly responsive servant, one that is tireless, able, multi-skilled, does not watch the clock, asks no time off, never complains about too many little and monotonous jobs, or balks at herculean tasks, and, unlike other servants, asks for very little pay. All of the talents of this extraordinary servant of mankind have not yet been discovered. Every so often it shows up with offers to take on new chores and discloses new attributes. There appears no limit to the ways in which electricity can serve or to the character of job, large or small, rough or delicate, that it can handle.

The desire of people for energy at their immediate personal disposal has demonstrated an unending tendency to grow. An industry that closely and profoundly affects the lives of practically all the people daily at their work and in their homes in a wide variety of tasks to be performed; one that is filled with problems, the solution of which can be accomplished in different ways and requires a high order of training, skill, and judgment; one that not only requires dealing with materials and the powerful forces of nature but requires wisdom and skill in the handling of relations with many people—employees, customers, officials of government, investors, and agencies in the world of finance; and one that continues to have vast uncharted boundaries—surely, such an industry is a challenge to any man deciding on his life's vocation. The electric light and power industry embodies all of these attributes.

The Burden of Production

Electricity carries the bulk of the burden of production in America's factories, and the trend indicates that its importance in this field will continue to increase. A century ago 79 per cent of the total energy used for work was supplied by animals, 15 per cent by human beings, and only 6 per cent by machines. By 1960 it is estimated that animals will supply only 1 per cent of our work energy, humans 3 per cent, and machines 96 per cent.

At the turn of the century, before the electrical revolution gained momentum, the worker in the factory was earning about $9 for a 54½-hour work week. Compare this with the 1953 wage of $72 for a 41-hour week, eight times the wages for a work week shorter by one-fourth. The increased productivity brought about largely through electrical development has made possible a tremendous range of products within the worker's greater ability to buy, and his standard of living has reached heights that would have then seemed unbelievable.

Our standards of living will continue to depend upon this country's productive capacity. Population increases tend to dilute our natural resources per capita, and there is a constant race to increase efficiency in the use of present energy sources and to develop new sources.

Basically, the electric light and power industry is an engineering operation and, because of its technical nature, always will be. The financing, sales activities, public relations, accounting, and legal phases of the business are all built upon its engineering characteristics. This industry has grown and developed no faster than engineering accomplishments would permit. Its future sound growth will likewise depend upon the vision, the bold concepts, the unremitting efforts, the ability to achieve, and the native leadership of its engineers. To stay in the vanguard of progress, it must always continue to have engineering leadership of top quality.

A Review of the Past

Let me mention briefly the growth that has taken place in the use of electricity. An appropriate review of the past helps us to judge the future. How has the modern power system been evolved? First came the inventor. Then came the always difficult and often insuperable task of financing unproven ventures. Simultaneously there followed, step by step, developments in electrical equipment manufacturing and in the construction of generating plants, transmission and distribution lines, operators to make the system work, and salesmen to induce people to spend their money for various types of electrically operated equipment so as to utilize our service.

At the beginning, the financial man, the designer, the constructor, the operator, and the salesman were usually all one person. But these entrepreneurs set in motion a process of improvement and expansion that has continued to this day, and, although 75 years have gone by, this expansion is progessing at a faster

rate now than at any time before.

It took the electric utility industry 37 years to obtain its first 10,000,000 customers; then in seven years from 1919 to 1926 the number of customers was doubled. It took 14 years, from 1926 to 1940, to add the third 10,000,000, eight years from 1940 to 1948 to reach 40,000,000 customers, and only five years to reach, in January of this year, a total of 50,000,000 customers.

The industry this year will install its 100,000,000th kw of generating capacity. In 1952, it added 6,800,000 kw. In 1953 it added 10,000,000 kw. According to the semi-annual survey of the Edison Electric Institute, there are scheduled in 1954 additions to capacity of 14,500,000 kw; in 1955, 11,300,000. This survey also showed that at the end of 1953 reserves of generating capacity were 17.6 per cent.

The investment of the electric light and power companies in facilities has increased from a little over $12,500,000,000 in 1945 to about $25,500,000,000 today. According to the United States Department of Commerce, expenditures for new plant and equipment for all industries in the country since the war have amounted to slightly over $150,000,000,000, which indicates that the electric utility companies' expansion accounts for one-twelfth of the total.

In 1953 the electric utility companies spent $2,852,000,000 for construction, and for 1954 it is expected to be about $3,000,000,000.

A Solution for Every Problem

The operating engineers, stubbing their toes, barking their shins, and skinning their knuckles against hard physical facts, men keenly observant in diagnosing troubles, in seeing what could be improved and how to accomplish it, consulting with their colleagues in the business, applying cut and try methods, demanding improvements from the designers, both in the manufacturing establishments and in the power companies, eagerly seized each new advance in science, overcame hurdles, broke through or around barriers, and tackled new problems as they arose, with the determination to solve them.

Undoubtedly, they were inspired by the philosophy of the great inventor, Thomas A. Edison, who said: "You know, I've been in the inventor business for over 33 years, and my experience is that for every problem that the Lord has made for me he has also made a solution."

There are now single generating stations about 2,000 times the capacity of Edison's famous Pearl Street Station in New York City. The extent of the distribution area first grew from a few city blocks to a few square miles and then continued to grow, until today a single power system may cover the greater part of a large state. Interconnections with other systems, operating in parallel and capable of extending help in times of emergency, have resulted in continuous electric arteries reaching from Western Pennsylvania to Texas and from the Great Lakes to the South Atlantic coast.

Records of Achievement

Starting out with a job of lighting a few lamps a few hours in the evening before the townspeople went to bed, then adding here and there a motor to take the arduous tasks from the arms and backs of workmen, then extending service for a few hours on Tuesday for ironing, then making service available 24 hours a day, every day in the week, to the cities and larger towns of the United States, and finally continuing to extend lines and improve the quality of service, until today electricity is available to about 99 per cent of the occupied establishments of the country — that's one record of achievement of our industry.

Paralleling this extension of lines has been the development and growth of a variety of applications of electricity. To indicate how electricity has worked its way into industry, 30 years ago the average manufacturing establishment used 1.6 kwhr per man-hour. At the present time this use is more than 7 kwhr per man-hour. Improved mechanization, automatic controls, and now continuous process production have greatly reduced manual operation in factories, placing the operators in the position of guiding the operations of individual machines, or monitoring from master control stations complex machines that perform many functions in a continuous operation.

Notwithstanding this greatly increased use of electricity in industry, its cost as a per cent of the average value of industry's finished product has continued to drop to a level of about .6 per cent.

In farming the use of electricity is climbing at a rapid rate. Electric service is now available to 98 per cent of all the occupied farms in the nation. On farms east of the 100th meridian, which roughly means the eastern half of the United States, where pumping for irrigation is not yet a substantial factor, the average use per farm is now about 3,100 kwhr per annum. Five years ago, the figure was about 2,000, and in 1940 it was about 1,000. It is fully expected that in a few years this average will be about 6,000 per annum. On some dairy and poultry farms the annual use already ranges from 30,000 to 50,000 kwhr.

Everywhere throughout the nation you'll find that the electric light and power companies are cooperating with the vocational agricultural schools, universities, U. S. Department of Agriculture, agricultural extension service and experiment stations, farm and farm youth organizations, and equipment manufacturers in making electricity do more and earn more for the farmer. Farming is a business and a source of great potential revenue for our industry. While electricity has lifted many major burdens from the farmer's shoulders, research and development in the farm field have far to go before electricity's contributions to agriculture generally can be considered comparable to those made to industry.

Householder Use

Electricity has lightened the burdens of the housewife and brought cheer, comfort, and entertainment into the home. First came the electric light, then the electric flat iron, toaster, vacuum cleaner, washer, range, water heater, refrigerator, electric mixer, oil burner, electric dryer, radio, and television set—just to mention a few items. Room cooling and space heating, now rather prevalent in the South, are gradually moving northward.

When Thomas Edison started the first electric lighting company in 1882, residential electricity sold for about 24 cents a kilowatthour. By

1932, the average price was down to 5.6 cents, and at the end of 1953 it had dropped to 2.74 cents a kilowatthour.

The household user paid only 1 per cent of his cost of living for electricity in 1953, as compared with 1.6 per cent in 1939, despite the doubling of the average use of electricity in the home.

Our industry has established a unique record during this era of inflation when the purchasing power of the dollar has dropped 50 per cent, when construction costs, Federal taxes, labor rates, and the price of fuels have more than doubled. Through engineering achievements, improvements in operations, and well-directed sales efforts, prices for electricity are lower today than they were before World War II. Where can you find another such example of accomplishment?

Conservation of Fossil Fuels

The operation of the present power supply systems of America, together with the many new problems that are arising and will surely continue to arise, calls for a goodly number of engineer-trained men of creative genius and talent for getting things done.

Take, for instance, the many questions pertaining to bulk power supply and sources of energy. The per capita rate of consumption of fossil fuels has been increasing at an accelerating rate. The same thing is happening in other parts of the world, which will affect our own future fuel supply. These same fossil fuels are being called upon as sources for other products, and their use for these purposes is growing and may some day reach large proportions.

Engineering by equipment manufacturers and by the utility industry during the past 75 years has already made a tremendous contribution to the conservation of fossil fuels. During that period the average coal rate of generating plants has been reduced from 138,000 Btu to 12,950 Btu per kilowatthour. The best plant in operation today is able to reach 9,200 Btu per kilowatthour, and manufacturers have on the drafting board units expected to have a heat rate of approximately 8,400 Btu per kilowatthour. Incidentally, it has been the history of the industry that the best performance in time tends to become the average performance.

A decade ago the top limit for turbo-generators on a single shaft at 3,600 rpm was about 80,000 kw. Today this top limit has been increased more than three times. Now there are being considered new generating units, although not on a single shaft, that would almost double again the kilowatt capacity per unit. Pressures up to 5,000 psi and temperatures of 1150 F seem within the realm of practical development. Metallurgical research is expected to lead to 1300 deg operating temperatures. Water will change directly into gas in the steam generator of the future, operating under the supercritical pressure cycle.

The supply of fossil fuels is not unlimited. The engineering profession, therefore, cannot neglect to harness other sources of energy as fast as this can be accomplished economically so that the public can enjoy the further benefits of low-price electric service. We cannot afford to be satisfied with our present achievements. Always we must be on the lookout for new energy sources that can economically be put to work. It is this consideration that justifies us in spending money on research and development. The feasibility of harnessing atomic power on an economical basis, able to stand on its own feet, is actively being studied, not only in America but in other countries.

Higher Transmission Voltages

Higher transmission voltages for more economical power transmission are entering a new era. Lines to operate at 330,000 v are now being constructed in this country. The vast interconnected power systems of today call for an advancing art of metering, telemetering, and system communication. Distribution design and practices are being modified in an endeavor to keep ahead of the requirements for serving the increasing demands of existing and new customers. More than 50 per cent of the electric utility industry's investment is in facilities for transmission and distribution.

There are other types of engineering tasks that must be capably handled in any power company. Progress in the application of electricity to industry and agriculture, in the lighting and air conditioning of commercial establishments, and in the wiring of customers' premises has increased the need for men with engineering education and training in the sales field.

Ingenuity Put to the Test

Then every so often a job comes along that puts to the test all of the ingenuity and skills of management and of our engineers, such as occurred in 1952 in the creation of the Ohio Valley Electric Corp. to supply 1,800,000 kw of electricity to the new atomic plant of the Atomic Energy Commission being built in Pike County, Ohio. This agreement calls for the largest block of power contracted in industrial history. Ohio Valley Electric was formed by 15 electric utility companies, doing business in Ohio and neighboring states, to meet this unprecedented demand of the government for power. Two huge steam power stations—one in Ohio and one in Indiana—and connecting transmission lines are now under construction to supply this energy, commencing in 1955.

As you can imagine, many problems confronted these companies before the OVEC contract was finally executed—the question of whether one or more power plants should be built, their locations with respect to load center and also to the sources of coal supply (these two plants will use a total of 7,500,000 tons of coal annually), the sizes of generators, the amount of reserve capacity, the transmission line voltages, the availability of skilled construction labor, and housing problems.

For instance, some 34 different proposed arrangements of generating and station sizes and locations were studied before the AEC announced the exact location of the atomic center. And after this location was announced, nine additional possible arrangements of generating station sizes and locations were studied, and it was from one of the latter that the final plan was adopted. And added to all this was the problem of the method of financing and obtaining $440,000,000 of capital.

The basic task of a power com-

pany is truly to serve people and serving them includes the job of always earning sufficient to be able to attract new capital at reasonable cost as needed for plant expansion. The engineer who becomes a part of a power company must have the breadth of capacity and vision to make his engineering best accomplish this broad purpose. It is a vocation for men with engineering talent who wish to make themselves truly useful to society.

There is need for men with a liking for design, for men who turn naturally toward special engineering fields, for men who like to handle operations and deal with men, for engineers with a talent for selling, for those who are capable of working with the public and with public officials, and for those with a liking for and natural ability in administration. A large percentage of the presidents of electric companies are engineering graduates, and a man with broad engineering and operating experience is in demand for management positions. History shows that in the electric utility industry, perhaps more than in other industries, the leaders of today have worked their way up their company ladders.

The supply of electric power has become so essential to so many activities of life that any man qualified by training to perform this type of work has a solid foundation for useful and satisfying employment. The fact that there are only partly charted and still uncharted frontiers, that there are major problems ahead, and that the demands for electric energy continue to grow, promise the ambitious and the energetic man that he will be kept busy trying to keep up with his responsibilities if he attaches importance to the opportunities that confront him in his work.

To exploit opportunities has never been an easy job. To raise the standards of living of people and to contribute to the well-being of the many is always difficult. If it were otherwise, men with lesser qualifications could do it.

Duquesne Light to Construct Nuclear Plant

LEWIS L. STRAUSS, Chairman of the Atomic Energy Commission, announced on March 13 that a proposal submitted for participation by Duquesne Light Co. in the construction and operation of the nation's first full-scale central station nuclear power plant is the most favorable to the government and that the AEC is negotiating a formal agreement with the company. The Duquesne Light Co. submitted one of nine major proposals to the commission.

Under the Duquesne proposal the company would:

1. Furnish a site for the entire project and build and operate a new electrical generating plant at no cost to the government.

2. Operate the reactor part of the plant and bear the labor costs thus entailed.

3. Assume $5,000,000 of the cost of research, development, and construction of the reactor portion of the plant.

4. Pay the commission at the rate of 48.3 cents per million Btu of steam used in the turbines for the first year; the rate increasing annually until it reaches 60.3 cents in the fifth year.

5. Waive any reimbursements by the government of cost incident to termination of the contract.

The chairman estimated that, including revenues from the sale of steam generated by the reactor, the company's proposal would reduce by an estimated $30,000,000 the expenditures the government would have to make during the period of construction and five years of operations if it undertook the full cost of the project.

The proposed plant site is on land presently owned by the company in the Greater Pittsburgh area. The reactor design will incorporate safety features developed through ten years of experience with reactor operation.

The Westinghouse Electric Corp. has a contract with the AEC to develop, design, and construct the reactor portion of the plant. The reactor is expected to generate sufficient heat to produce a minimum of 60,000 kw of salable electricity in addition to meeting the electricity requirements of the plant itself. The actual capacity of the reactor may turn out to be somewhat greater than the minimum of 60,000-kw design, and, foreseeing this possibility, the company would design its generating plant with some reserve capacity.

It is not expected that this first plant will produce electric power at cost competitive with power from conventional fuels. The project has been undertaken in order to gain more design and technological experience than could be obtained otherwise, such as from a smaller plant, and to provide firm cost estimates for the future.

This type of reactor, known as the Pressurized Water Reactor (PWR) will be cooled and moderated by ordinary water under pressure. The fuel will be slightly enriched uranium, that is, it will have a slightly greater concentration of uranium 235 than occurs in nature. This type of reactor was selected because research and development on it is more advanced than on other types. Several early reactors were water cooled, and this technology also was advanced to a very great extent by the work of Westinghouse on the Submarine Thermal Reactor developed to power the "Nautilus" and on the large naval vessel reactor project.

The Duquesne Light Co. supplies electric power to the Greater Pittsburgh district, one of the world's largest industrial centers. Since last October the company has engaged in nuclear power reactor studies under the AEC's Industrial Participation Program. Preceding its entry into this study, the company arranged to have some 40 of its engineers attend a special course on atomic energy at the Carnegie Institute of Technology.

In announcing the negotiations with Duquesne for participation in the PWR project, Mr. Strauss pointed out that this project represents only one of several approaches to the development of technology and equipment for economical electrical power production from atomic reactors. He called attention to the announcement by Dr. Henry D. Smyth, member of the commission, of other approaches that the commission has concluded should be undertaken, including breeder, boiling water, homogeneous, and sodium-graphite reactor projects.

From *Public Service* for March, 1954, published by Duquesne Light Co.

Thoughts on Tomorrow

Frank M. Tait

Chairman of the Board, The Dayton Power and Light Company and
The Dayton Pump and Manufacturing Company

LET us turn away for a few moments from our worries about everyday problems, from our customary dash after taxis, after dollars. Let us stop to think of the challenge of things to come, for us as individuals, as a nation, and as the human race. Especially, let us not have the scientist, the educator, the businessmen, and the others get so involved with taxis, dollars, and worries that they fail to see the forest because of the trees.

This is a plea to America to keep its eyes on the far horizon of scientific, social, and spiritual advancement to attain new heights of human welfare. It is a plea from a businessman who has been fortunate to have a long and happy life, who devoutly believes that all the tomorrows can and must be of even greater value to the human race than the todays and yesterdays.

In the early years of my life, such wonders as the telephone, phonograph, incandescent lamp, linotype, automobile, movies, and the airplane came into popular use. Since then have come such fascinating developments as home radio, television, refrigerants, "wonder drugs," jet planes, and the use of atomic energy.

So I have seen the tremendous strides of the age, with the resulting beneficial gains in the comforts and conveniences of life as we have it today, the best on earth, the best in mankind's history.

Limitless Horizon

But we have only started. The horizon is limitless. The developments that I have seen might have led to the belief that we have saturated our capacity to progress. On the contrary, my experience makes me believe—know—that we are only beginning. What we must not do, ever, is to slow up, hesitate, or, heaven forbid, stop! The future *is* there!

Certainly there are potentials in every field. What of civilian uses of atomic energy for power and heat? What of interurban rockets to whisk us around the country in minutes, or around the universe for that matter? What of harnessing the energy of the sun, and controlling weather? Or new building and clothing materials, new agricultural and manufacturing processes? New drugs, cures for our now incurable maladies? What of social gains that eliminate slums, decrease crime and delinquency? And, probably the hardest job, what of progress in human relations, toward fewer wars, broken homes, broken minds, broken lives?

The job is there, and I know work is being done on some of these projects and many, many more that I do not know about. I cannot see what the future will bring. But I can see the job is there to do; that as smug as we might be now about our standard of living, we are on the threshold of a greater era.

Intelligent Thinking and Hard Work

Obviously, the way we are going to achieve that greater era, and the still better ones to follow, is through intelligent thinking and hard work. That is how we have reached the place we are at now.

It works. I know. Let me tell about a couple of personal examples of why I know.

Back near the start of my public utility career, we had a job to do which today seems almost unbelievable. We had to sell electricity, and it was tough. Home and industrial uses of electricity were relatively new; sometimes electricity didn't work just right; there were conversion problems and the consequent expense for a potential customer. Lots of reasons were given why people didn't want service from a central station, as it was known then.

But central station operators worked hard. And more people bought electricity. And more power stations were built. Generation and distribution methods were constantly improved. Manufacturing grew with electricity, more products were made better and cheaper, and life at home and work improved.

Now, where would you or I be this minute without electricity at the flick of a switch at home or at work?

You see the equation: the wonder and adaptability of electricity, plus human thought and work, equal progress in day-to-day living. And mankind moved on.

There is another brief personal example. In those early days of electricity, I became interested in a pump company. At that time, obtaining water with a hand pump was a laborious task. So our company combined the marvel of electricity with the job of a pump and produced the first automatic electric water system. Thus, the electric water pump joined other devices in efficient service to humanity. And mankind moved on.

But of course there is not always success in the inventor's, the manufacturer's, or the individual's pursuit of the solution to a problem. In fact, there are usually many more disappointments than there are joys. Curiously, I learned that truth very early in life from America's greatest and most successful inventor, Thomas A. Edison.

20,000 Things that Won't Work

When I was a youngster, Mr. Edison came to my hometown of Catasauqua, Pa., to conduct experiments in the processing of iron ores for use with anthracite coal. He needed a boy to help him, and I got the job, working with him to the successful conclusion of the experiment. What a man he was! Despite the disparity in our ages, his tireless efforts almost wore me out.

Right then, and throughout our lifelong friendship, I learned that only with hard work and progressive thinking can results be obtained—regardless of disappointments. Edison stories about this philosophy are numerous. There is the one, for instance, in which Edison said that he had made

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20,000 experiments on a problem but that none of them had worked. Nevertheless, he wasn't disappointed because, as he said, "There's nothing wasted. I have discovered 20,000 things that won't work."

Yes, there are disappointments. But there are gratifying results, too. Edison made more than a thousand creations, many of which we use and enjoy every day, such as the incandescent lamp, phonograph, movies, to name a few.

Naturally, results count. Disappointments must merely be considered as delays along the way.

Why Do We Work?

So, we humans have come a long way and are going a long way farther through thought and work. It seems to me that the basic question then becomes—why? Why do we work? Why do we seek new and better materials and methods? Why do we look toward the future, with additional progress as the goal?

For personal gains? Some people do, and in many cases they are the unhappy ones, the shallow, distrustful, embittered ones. Of course there must be material gain in everyone's life. But it cannot be the end result of effort. There is, there *must* be something more, and that is the satisfaction of contributing something useful, the sense of "belonging" through carrying our share of humanity's load.

Thus, we must serve, for our own progress and for the progress of our fellow man.

I know a man, successful in his vocational field, who has devoted countless hours to the work of his lodge and its contributions to the community. This man has served. He did not and will not get a penny for it; his work even is virtually anonymous. But his community—humanity, if you please—has gained.

I know another man, general manager of one of America's industrial giants, whose religious way of life, and his active work at it in city, state, and nation, is of untold inspiration to others.

Can that man measure his personal satisfaction in money or anything else? He probably doesn't even think of it, but he radiates a quiet contentment that is most expressive of personal peace.

In my own case, I have found that my richest possession is the thought that I have contributed, in my own way, to the well-being of the people of my community through my lifetime industrial efforts. Many of us have that feeling. From my career that has spanned more than a half-century, I know that inner satisfaction is, by far, most important in life.

In Pennsylvania's Lehigh County, where I grew up, there are a lot of good Welsh people. One of the stories there was of a mighty Welsh choir; they are great singers, you know. The choir was comprised of 1000 tenors, 1000 sopranos, 1000 altos—and one man as the bass. And when those 3001 persons started to sing, the conductor had to stop the choir and caution the lone bass singer: "Not so loud, bass!" What a contribution he made!

We all cannot make that much of a contribution. But each of us can help in the challenge of things to come, and never before in history have there been so many opportunities, so many possibilities. Through our cumulative service, humanity will continue to benefit, and, with God's help, there will be a greater era tomorrow—and all the next tomorrows.

Robert G. Ely

ROBERT G. ELY, Sales Vice President, The Connecticut Light and Power Co., died of a heart attack on February 21 at his home in Farmington, Conn.

MR. ELY

Only 47 years old, Mr. Ely had selflessly contributed his abilities to the work of the Institute for 13 years. He served as chairman of the Industrial Power and Heating Section from 1949 to 1951, having been a member of the section since 1941. From 1949 to 1951 he was also vice chairman of the Commercial Division General Committee. He was responsible for preparation of the "Production Method Analysis" section of the *Power Sales Manual,* and, at the time of his death, was a member of the Rate Research Committee.

A native of Schenectady, Mr. Ely attended Union College and graduated from Cornell University with a degree in mechanical engineering. He became associated with Public Service Electric and Gas Co. in 1926. Following a six-month cadet training course, he worked on the power sales staff of the Jersey City and Newark offices until 1933, when he was placed in charge of the power sales work of the Jersey City District. In 1937 he was made assistant manager of power sales for the entire company. He also participated in organization of company training courses covering sales and electric power applications.

He joined Connecticut Light and Power as director of sales in 1951 and the following year was named sales vice president.

A licensed professional engineer, Mr. Ely was chairman of the Connecticut Farm Electrification Council and chairman of the New England Farm Electric Service Committee of the New England Council. In past years he had served as chairman and board member of the Interstate Power Club and as member of the ASME Oil Engine Power Cost Subcommittee and the Materials Handling Society of New Jersey. While a resident of New Jersey, he had been active in the Newark and Morris County Community Chest organizations, Madison YMCA, and Morristown Memorial Hospital Building Committee.

Mr. Ely is survived by his widow, two children, one grandchild, his mother, and two brothers.

Employee Selection—An Important Element of Clerical Cost Control

E. R. Eberle
Assistant to the General Commercial Manager,
Public Service Electric and Gas Company

A paper sponsored by the Joint EEI-AGA Accounting Employee Relations Committees

CLERICAL cost control has today become a matter of prime importance to companies in the electric and gas industry. The current high salary level for clerical work in accounting and other office departments, together with the continually increasing work requirements of these departments resulting from the expansion of business, highlights the urgent need for improving clerical efficiency. Managerial skill and "know-how" must solve this problem.

Basic to Efficient Organization

Good employee selection and placement are basic to progress in developing an efficient organization. Ineffective selection methods will result in higher training costs and high turnover, with further additional costs for the training of replacements. The company that is successful in selecting properly qualified workers will gain the benefits of more effective work production.

It is fundamental that the worker must have capacity for his particular task, or he will fail. On the other hand, if his ability exceeds the requirements of the job, and this condition continues for too long a period of time, he will become dissatisfied, unhappy, and may leave the company. This two-pronged danger points up the need for analyzing individual jobs as to both requirements and opportunities. In placement work these factors are just as important with respect to satisfactory job performance as are an applicant's ability, education, background, and physical qualifications.

The broad objectives of a sound selection procedure include steps that tend to:

1. Avoid hiring employees who will prove to be unsatisfactory and who will sooner or later leave.
2. Avoid hiring employees whose abilities cannot be adequately utilized and who will later leave.
3. Avoid hiring mediocre employees, who will prove ultimately to be a burden to the company and who will have an adverse effect upon the morale of other employees.
4. Insure that the maximum number of those hired will be well-qualified and properly adjusted individuals.

Much of the material in this study has been obtained from a survey of 15 large utility companies, and many of the procedures outlined are based upon the reported experiences of these companies.

The selection procedure includes six fundamentals:

1. Recruiting.
2. Interviewing.
3. Testing.
4. Physical examination.
5. Checking references.
6. Final selection and placement.

Recruiting

The companies surveyed uniformly recognized that recruiting is indispensable to good selection. Rarely indeed, particularly in today's labor market for office workers, can an employer expect to wait for many well-qualified prospects to come to him.

Recruiting requires careful planning and hard work. Continuous efforts are necessary to maintain a reasonable supply of applicants. Recruiting sources used include the following:

1. State and Federal employment agencies.
2. High schools, commercial schools, business schools, and colleges.
3. Private employment agencies.
4. Employees' friends and relatives.
5. Newspaper advertising.

Some companies have successfully established working connections with high school and business college placement personnel, to the end that they refer promising candidates in the graduating classes for interviews.

Interviewing

The practice followed by all of the companies studied provides for the filling in of an application form by all applicants for clerical positions, except those individuals who obviously are not qualified for any kind of employment.

Some companies have found it desirable to have two interviews by experienced interviewers. The first interview serves primarily as a general screening procedure. The second interview is comprehensive and is conducted in most cases after the applicant's references, school record, test results, etc., have been checked.

The interviewing procedure, in any case, should be designed to screen out at an early stage those applicants who are clearly not qualified. This can be accomplished through the use of well-directed questions which relate to minimum qualifications. Use of a check-list can facilitate the covering of such items as age, schooling, previous positions held, reasons for leaving, skills, physical disability (if any), etc.

Many of the larger companies surveyed follow the practice of having the screening, interviewing, and testing procedure handled by a central employment or personnel department. Qualified applicants are then referred to individual departments where the final decision as to whether or not they are to be hired is often made by the first line supervisor. In smaller companies all of this work is handled by the line organization.

Regardless of the size of the company, it is widely recognized that the role of the interviewer doing the screening is vital, particularly with respect to selection of employees for clerical work. Only highly-qualified and well-trained interviewers should

handle this work if maximum results are to be obtained. The interviewer must be fully conversant with the continual shifting of personnel needs within the company, with changes in work load and requirements in the various departments. With respect to job vacancies he must be well-versed in operation and procedures. He must be fully acquainted with the following facts concerning each specific vacancy:

1. Job name or title.
2. Work performed and location.
3. Ability requirements.
4. Level of intelligence required.
5. Skills required.
6. Hazards (if any).
7. Physical requirements of the job.
8. Promotional possibilities.
9. Salary scale.

In addition, the interviewer is expected to appraise the applicant in a general way and to assay certain intangible factors such as motivation, loyalty, stability, dependability, etc. In the final analysis, much of the success of a selection program will depend upon the skill of the interviewer in the performance of his work.

The part first line supervisors play as interviewers must not, however, be overlooked. Because they are not skilled interviewers, they can do little more than supplement the screening already done by the experienced interviewer. The purpose of their interview, in addition to making the final selection, is to acquaint the applicant more fully with the job to be done and to give the supervisor and applicant an opportunity to "size each other up."

Testing

Employment testing is a procedure that is today widely used in industry as a valuable tool or aid in the selection of new employees. Thirteen of the 15 companies participating in this survey report that they are currently using various types of tests.

Selection tests are designed in the broad sense to measure the applicant's "can do" qualifications. They are usually of two general types. One type, known as the proficiency test, is designed to examine and measure the applicant's skill and knowledge; the other type, known as the aptitude test, is designed to examine the applicant's potentialities or "trainability."

Use of employment tests can be of value to the employer because they can provide a reasonably accurate measure of qualities that are otherwise difficult to evaluate. They can measure the applicant's level of intelligence, his clerical aptitude in such terms as speed and accuracy, and his proficiency in such skills as arithmetic, typing, shorthand, etc. Tests are free from bias, and the test results are not influenced by the applicant's appearance or personality traits.

From the applicant's point of view, tests afford him an opportunity to demonstrate to a prospective employer what he can do. Furthermore, tests can help in guiding the employer in the proper placement of the individual.

One reporting company stated that it believed that testing had definitely served the purpose of eliminating a substantial number of unqualified applicants. Tests were characterized by this company as a reasonably reliable method of predicting successful performance on the part of an applicant, but the company cautioned that testing is by no means a fool-proof method of insuring selection of successful employees.

Careful Administration

A successful testing program requires careful administration. The applicant should be put at ease. The interviewer should explain to the applicant that he will be asked to take a number of tests in order to enable the company to obtain a better picture of his background and abilities. It is obviously important that the applicant understand the objectives of the testing procedure. An effort should be made to dispel any fear of tests. He should be told that all applicants take tests as a prerequisite to consideration but that tests are only one phase of the over-all appraisal procedure. It should be pointed out to him that the test will enable him to demonstrate his abilities.

Testing is primarily an aid to management in probing the qualifications of individual applicants. Only those tests should be given that will indicate capacity in the line of work for which the applicant is being considered. It must be recognized that employment tests cannot provide measures of motivation, willingness to work, perseverance, honesty, and ability to get along with others, because these qualities depend very largely upon human will and personality rather than on ability.

Accordingly, it is clear that tests alone cannot do a complete job of selection. This points to the importance of the interviewer in his analysis of the applicant's "will do" characteristics. This also points to the importance of another phase of the selection procedure, namely, that of checking references. This latter step will frequently give valuable leads as to an applicant's "will do" characteristics by disclosing what he "has done."

The practical value of specific tests to a company can be determined only after they have been used for a period of time and after test scores can be checked with actual productivity on the job. Eventually, norms can be established that can serve as reasonably reliable guides in selecting new employees.

There are many tests on the market designed to be used in selection of office workers. Twenty different types of these tests are currently used by the 13 reporting companies that do testing. The maximum number of different types of tests used by any one reporting company is eight, and the average is between three and four.

Physical Examination

It is, of course, just as important for an applicant to be physically qualified for a job as to be mentally qualified. The danger of employing individuals for clerical jobs, who are or may become industrial hazards, is very real. Likewise, certain district office jobs in the clerical group involve field work and impose varying physical demands.

A physical examination is today very generally recognized as an employment prerequisite. It serves the purpose of eliminating applicants who do not meet minimum physical requirements and also serves to screen out borderline applicants. By this means, some control is maintained with respect to the potential additional costs and problems that attach to the hiring of individuals who, because of underlying physical reasons, may well be absence-prone or poor performers.

Many companies question the value of references of applicants' friends or acquaintances. They point out that an applicant would not submit the names of any individuals who would

not be willing to provide a favorable reference.

Most of the reporting companies, however, indicated that they felt that references from school authorities and prior employers, if properly checked, can provide valuable and useful information. Almost uniformly, the companies indicated that they rely upon the telephone rather than the printed inquiry form, because information obtained by telephone is far more apt to be complete and accurate than information obtained by letter. Some companies do resort to correspondence when the applicant comes from a considerable distance or when the former employer cannot be reached by telephone.

As a typical example, one company makes a practice of checking the clerical applicant's last three jobs. In addition, information is obtained concerning the applicant's past paying habits by checking with the local credit reporting bureau. Some companies also make a regular practice of checking applicants with the local Police Department before actual hiring.

Checking References

In checking references with prior employers, a number of companies use check-lists to insure that all important points are covered. Typical questions include the following:

1. What were his dates of employment with your company?
2. What type of work did he do?
3. Was his performance satisfactory?
4. Why did he leave?
5. He says his earnings were so much per week; is that correct?
6. Was he always honest in financial transactions?
7. What was the extent of his lost time from work? What were the reasons?
8. Does he have any domestic or other difficulties or habits that might adversely affect his work?
9. Would you reemploy him? If not, why not?

When selecting applicants directly from high schools or commercial schools, one participating company reported that by maintaining close liaison with the schools it had been able "to obtain accurate, detailed information on an applicant's scholastic standing, academic accomplishments and interests, extra-curricular activities, and also analysis of the best-suited job for the individual as indicated by the vocational guidance instructors."

Human nature is surprisingly constant. Deficiencies disclosed by a prior employer or by a school record will quite likely not be eliminated over-night. Similarly, experience has shown that individuals who have consistently been good performers for previous employers, or who have had outstanding school records, will have a better chance of proving very satisfactory workers than those with less favorable records.

Checking of references, if properly handled, can aid materially in the selection procedures by bringing to light information, both favorable and unfavorable, as to an applicant's past history and performance.

Final Selection and Placement

Today, many industrial companies faced with clerical help shortages, find that selection and placement is primarily a process of hiring any applicants who can be found who meet minimum requirements.

Utility companies may possibly be a bit more fortunate in this respect. In any case, the participating companies reported that shortages of clerical help had not in general forced such short circuiting of the selection procedure. They stated that in the final step of the selection process, the accumulated data regarding an applicant is evaluated and compared with the individual job requirements. The interviewer has the responsibility for analyzing the applicant's apparent ability, character, motivation experience, school record, test results, and ability to get along with others.

He must, in addition, be sure that the applicant fully understands the job requirements. Some companies have found that meter readers were leaving after exceedingly short periods of employment, simply because, prior to hiring, the applicants had not fully understood what the work actually required. If it is apparent that the applicant is qualified for a particular job, the interviewer must try to make sure that the applicant wants the job and is convinced that the job is right for him.

In most of the companies surveyed, it is the practice for the supervisor in the department in which a vacancy exists to make the final decision as to whether or not the applicant shall be hired. In these cases, the applicant is interviewed by the supervisor. The supervisor is given the records pertaining to the applicant, together with the interviewer's recommendation.

The first line supervisor is in a

(*Continued on page* 128)

Graduation Exercises Conclude Ebasco Seminar

THE Seventh Ebasco Seminar on Public Utility Safety was concluded with luncheon and commencement exercises at the Downtown Athletic Club in New York, N. Y., on March 19. Under direction of W. T. Rogers, Ebasco Safety Director, the seminar is sponsored each year by Ebasco Services Inc. in cooperation with the staff of New York University's Center for Safety Education.

Officials of Ebasco and the university addressed the luncheon meeting, during which representatives from major utilities in the United States, Chile, Costa Rica, Panama, and Venezuela received certificates for participation in the seminar. A highlight of the graduation activities was the presentation of the 100th Ebasco Safety Seminar Certificate to Bill C. Hall, Safety and Training Supervisor, Carolina Power & Light Co. The class valedictory speaker was Roy P. Moller, Head of the Employment and Employee Welfare Department, The Washington Water Power Co.

In addition to attending classroom sessions on safety programs, effective speaking, human relations, training techniques, and special aspects of public utility safety, participants had made field trips to the training school and service center of Long Island Lighting Co. and to the testing laboratories and System Operation and Safety Departments of Consolidated Edison Co. of New York, Inc., during the two-week seminar.

The seminar group had also witnessed modern fire-fighting demonstrations at C-O-Two Fire Equipment Co. and visited the headquarters of the First Army on Governor's Island to review the army's driver-training program.

Operating and Maintenance Experience in Outdoor Generating Stations

M. H. Long
Maintenance Supervisor, Goldsboro Steam Electric Plant, Carolina Power & Light Company

J. S. Newbold
Superintendent, Lumberton Steam Electric Plant, Carolina Power & Light Company

A paper presented before a meeting of the EEI Electrical Equipment Committee, Detroit, Mich., February 16, 1954

WHEN the Carolina Power & Light Co. was faced with the problem of deciding what type of new generating plants to build, one objective was kept clearly in mind—plants that would result in the greatest over-all economy in construction, operation, and maintenance costs. It is easily possible to effect savings in one of these specific elements of design at the expense of the other element; this, however, may not be true economy. To approach true economy, it is often necessary to forego obvious economies in one element of design in order to take advantage of much greater economies in the over-all cost.

Three Outdoor Plants in Operation

The final judgment of our management and engineers was that a greater over-all economy would be realized by omitting part of the conventional plant building, even though this omission would undoubtedly introduce maintenance problems different from those encountered in the past. This discussion will deal briefly with some of these problems that have actually materialized.

Our company now has in operation three semi-outdoor plants: Cape Fear, Lumberton, and Goldsboro. Since more equipment is located outdoors at the more recently designed Lumberton and Goldsboro Plants, this discussion will be limited to the two newer plants.

The first of the three generating units at the Lumberton Plant began operation in September, 1949, and the last in August, 1952. At Goldsboro the first unit began operation in May, 1951, and the second in June, 1952. The gross capabilities of these plants are: Lumberton, 185 mw, and Goldsboro, 169 mw.

The normal Lumberton Plant organization includes a total of 87 men, divided as follows:

Superintendent	1	Test men	7
Supervisors	3	Coal handling men	11
Foremen	8	Clerical	2
Operators	23	Janitors and yard men	8
Maintenance men	24		

These men are normally scheduled on a 40-hr-week basis. There are six men per shift on plant operations. These are a shift foreman, a control operator, an assistant control operator, two auxiliary operators, and a helper.

At this point it would be appropriate to report on weather conditions under which the Lumberton Plant has operated since September, 1949. The minimum temperature recorded was 16 F. The maximum temperature recorded was 112 F. Each year freezing temperatures have been experienced in each of the five months from November to March, inclusive. Temperatures below 32 F were generally recorded in the early morning hours, with the temperature rising above freezing during the daylight hours. No record could be found where the temperature remained below 32 F for a 24-hr period. The lowest average monthly temperature experienced was 39 F.

Amount of Enclosures

There is some difference in the extent to which enclosures have been provided for some of the equipment, primarily, the turbo-generators. Lumberton 1 and 2 turbo-generators were provided with individual metal enclosures containing removable hatches in the roof so that the gantry crane can be utilized. On the Lumberton No. 3 Unit and the Goldsboro No. 1 and No. 2 Units, the turbo-generator enclosures consist of walk-in housings over the exciters and turbine front standards.

In most instances the amount of enclosures provided for the other equipment are similar on all units, with enclosures under the turbine and boiler operating decks provided for the boiler feed pumps, condensate pumps, feed-water heaters, pulverizers, tripper conveyors, and air compressors and no enclosures provided for the steam generators, fans, and circulating water pumps.

Maintenance Schedules

From a system-wide standpoint, there is some difference in planning the annual maintenance schedule for outdoor turbo-generators in that the expected weather conditions during different seasons of the year must be taken into consideration. When possible, inspections of the turbo-generators are scheduled in the spring and early summer seasons. Fortunately, from a system-operation standpoint, this same time of year has been the most advantageous for having these units out of service.

There will be times, no doubt, when it will be necessary to perform scheduled and unscheduled maintenance on the turbo-generators during adverse weather conditions. It is believed, however, that these instances will be infrequent, and it is recognized that the outage time required may be slightly longer than would be necessary if the turbine were enclosed by a building.

From an individual plant standpoint, the main difference in planning the maintenance program on the turbo-generators for an outdoor plant is that provision must be made so that

unfavorable weather will not cause undue delay. Therefore, a prefabricated frame constructed of pipe is erected and covered with waterproof tarpaulins over the turbo-generator unit to be inspected. This structure is so arranged that it may be set up and moved over any portion of the machine during the overhaul period. Adequate protection against rust and dust is provided for all joints and precision parts by the use of anti-rust compounds and tarpaulins. This protection requires some additional man-hours. We estimate that the inspection outage time is extended appproximately 5 to 10 per cent to protect and clean parts normally protected by the building in an indoor plant.

It is true that there are times when the weather makes it unwise to work directly on the turbo-generator unit during the overhaul period. During periods of heavy showers or extended rains, it is impracticable to provide adequate protection for men and machinery to perform work requiring the use of the gantry crane. These infrequent periods can be utilized fully performing work in protected areas on auxiliary equipment.

Maintenance Speeded

It is time consuming, of course, to shift men and tools, but there are very few instances of this nature. We have found that about 80 per cent of the time the weather remains clear and working conditions are favorable, and about 75 per cent of the time working conditions are more pleasant than in an indoor plant. It has also been our experience that being out in the open, having natural light and sufficient space, are helpful in speeding up maintenance work. Up to this time, it has not been necessary to extend a turbo-generator outage beyond the allotted time because of weather conditions.

An interesting sidelight on the outdoor construction is the fact that during a particularly wet and cold period in the first winter's operation the proposal was made to enclose the section between the bunker floor and the firing level to provide shelter for the auxiliary operator on the boiler. While plans were being considered for this change, the operators themselves requested that the firing level *not* be enclosed, for they felt that working conditions on the outside would be much better throughout most of the year. Accordingly, no change was made except that a small, glass-enclosed, heated sentry box was provided for the auxiliary operator's use during the winter season.

As far as steam generating equipment is concerned, maintenance is much easier to perform than on an indoor unit. Although the entire boiler structure, the induced and forced draft fans, the soot blowers, and the burners are exposed to the weather, no additional maintenance other than painting is required for this equipment. As a matter of fact, the outdoor arrangement is an asset in maintaining this equipment in both routine maintenance and planned inspections.

We have found that there is a saving in man-hours brought about by the more pleasant working conditions. Certainly the working area is cleaner and more adequately lighted during the daylight hours. With the exception of rigging, maintenance of fans is more convenient because of the grade location and accessibility. Heavy lifting on the fans is handled by A-frames mounted on a truck or bulldozer or, in some cases, by a 4000-lb lift truck.

More breeching and duct maintenance is required than on the conventional indoor unit. More painting is required for the boiler casing and structural steel, since these are exposed to the weather. This painting is scheduled during the spring, summer, and fall months, while the indoor painting is scheduled during the winter months. We have found that approximately 600 man-hours are required to paint a 500,000 lb-per-hour boiler structure.

The expense of this additional painting is partially offset by the savings realized from a small clean-up crew. A small crew is sufficient, since rain washes down the boiler structure and the floors can be washed down with a hose.

Antifreeze Protection

From a maintenance standpoint, the outstanding difference between an indoor and an outdoor plant is in making repairs to outdoor equipment that requires special antifreeze protection. To appreciate this difference, a brief description of the antifreeze protection will be necessary.

The boiler feed-water piping and all lines above ¾-in. diameter, which can either be drained or through which a flow can be maintained at all times, are not protected other than by the regular heat insulation. All other piping is divided into two systems for design purposes—Cold Pipes and Hot or Cold Insulated Pipes. The Cold Pipe system includes cold water piping, compressed air piping, and all other lines which require protection but never exceed 125 F in temperature, while the Hot or Cold Insulated Pipe system includes all lines requiring protection that may be either hot or cold. All the piping included in the latter system has a covering of regular heat insulation. Heat for antifreeze protection is supplied to both of these systems by resistance wire and strip heaters.

On the Cold Pipe system two coats of weather-resistant paint were applied prior to the application of the heating cable. The cable was installed on the lines by two different methods, depending upon the size of the line. On the 2-in. nominal pipe sizes, or bundles of small tubing up to 2½-in. O.D., a single run of cable was attached to the bottom of the pipe or run inside of a bundle or group; while for pipe sizes above 2½-in. nominal diameter, or bundles of small tubing above 2½-in. O.D., the cable was applied spirally at the rate of 1½ lineal feet per square foot of bare external pipe surface. In either application, the cable was attached to the bare pipe every 6 in. with Scotch Electric Tape.

Foamglass Insulation

After the heating cable was installed, either a 1-in. or 1½-in. thickness of Foamglass insulation was applied and held in place with monel wire—two pieces per 18-in. width of insulation. This Foamglass insulation was then brushed with one coat of cold-setting cement. Next, a covering of .019-in. corrugated aluminum was installed, with the longitudinal joint on the bottom on horizontal runs and the ends overlapped about 1 in.

All joints were then sealed continuously with cement to form a weatherproof joint. The aluminum jacket was further secured by applying single turns of aluminum bands at 16-in. intervals and at all cement-sealed lap joints.

On the Hot or Cold Insulated Pipe System the regular heat insulation was first wrapped with a single ply

of building paper and then wrapped with a single ply of 0.004-in. aluminum foil. The heating cable was either run straight or wound spirally around the aluminum foil, depending upon the diameter of the pipe and heat insulation. The cable was attached every 6-in. with Scotch Electric Tape. Next, Foamglass insulation was placed over the heating cable and brushed with a coat of cold-setting cement. The corrugated aluminum covering was then attached in the same manner as on the Cold Pipe system.

On valves and fittings where it was impracticable to install the outside corrugated aluminum covering, the cement was painted with a coat of aluminum paint.

Heat is supplied to the antifreeze protection equipment by thermostatically controlled 110- and 220-v Electric Heating Cable, consisting of Teflon-covered No. 19 nichrome resistance wire rated at 6.5 w per lineal foot and of electric strip heaters.

In performing maintenance work on lines and valves protected in this manner, the antifreeze protection must be removed and replaced very carefully. This work requires additional man-hours. On future installations the design will be such that this problem will be simplified.

Small auxiliary pumps, such as screen wash pumps, service water pumps, and cooling water pumps, are also protected with antifreeze insulation since they are operated intermittently. Although these pumps are usually moved to the shop for inspection or overhaul, as is done in an indoor plant, more time is required to perform the work because of the antifreeze protection.

Repair More Difficult

Heater level control valves, drain piping, control lines, gage lines, and sampling lines are more difficult to repair when both thermal and antifreeze insulation has been installed. At the Lumberton Plant most of the flow meters, level indicators, and instruments are located in a central control room, which, of course, is heated. At our Goldsboro Plant most of the flow meters and instruments are located in a heated cubicle on the firing aisle elevation, or in some other protected space, and the intelligence transmitted either pneumatically or electrically to the control center.

In both instances, however, all control lines from the boiler and the flow nozzles require antifreeze protection. The installation of these control lines in bundles or groups, with a single antifreeze insulating jacket, presents a problem when it is necessary to repair leaks. On our most recent units this problem has been materially reduced by the use of insulated sheet metal ducts in place of antifreeze insulation. When the ambient temperature requires it, hot air is circulated through these ducts.

The static water in the control and gage lines makes them especially vulnerable to freezing at low temperatures. With the centralized control room it is imperative that the controls and gages give a correct indication of plant conditions. Therefore, especial care is taken to insure that these lines are adequately protected. With the exception of expected "bugs" found during the first winter's operation of a unit, the antifreeze protection of this critical equipment has been entirely satisfactory.

Heater Maintenance

Since all outdoor motors are of the splash-proof type, we have experienced no unusual maintenance difficulties. The majority of our motors are equipped with sleeve bearings, which we have found to be reliable for outdoor service. Initially, all outdoor motors were not provided with strip heaters that would automatically cut in when the motor breaker was opened. We have since found it necessary to install these heaters on all outdoor motors. This has contributed materially toward reducing condensation in the motors.

Since it is important that these heaters operate properly in an outdoor plant, we have been very careful to keep them in good condition. In doing this, we have found that to replace or repair a heating unit, which was initially installed by the motor manufacturer, it was necessary to dismantle the motor partially to get to the heater. To reduce the amount of work required to maintain these heating ele ments, we are changing their location from the air intake to the air discharge, where they are accessible for repairs without removing the motor end bells.

The amount of attention required for outdoor load centers and motor controls compares closely with those designed for an indoor installation. We have had, however, several instances of condensation in motor-operated valve controls, in communication relay boxes, and in speaker-matching transformer boxes; but this trouble has been practically eliminated by insulating the vapor-proof enclosures with an anti-sweat material.

Communication hand - set microphone boxes also have been a source of grounds on the communication system. This trouble has not been due to the location of the boxes but rather to the enclosure doors having been left open.

Since the coal handling equipment, pulverizers, boiler feed pumps, condensate pumps, heater drain pumps, and extraction feed-water heaters are protected from the weather similarly to indoor plants, no unusual maintenance problems have been encountered.

It is true that there are some maintenance problems that are peculiar to an outdoor installation. With the experience that we have now gained in maintaining outdoor equipment, we are confident that most of these problems can either be eliminated or greatly reduced in the initial design of an outdoor plant. In the near future we will have the opportunity to confirm this confidence. Our company now has under construction an outdoor plant at Wilmington, N. C. In this plant all auxiliary equipment, as well as the turbo-generators and the steam generators, will be located outdoors. In the design and construction of this plant, particular attention is being given to the maintenance problems that have been encountered at our Lumberton and Goldsboro Plants, and we are attempting to prevent their recurrence.

Both operators and maintenance men who have transferred from indoor to outdoor plants are unanimous in their preference for the outdoor plant.

Recent EEI Publications

The Ohio Conservancy Law and the Ohio Conservancy Districts

EEI Pub. 54-1. Prepared by the Natural Resources and Agricultural Subcommittee of the Area Development Committee. 25 pages. Price: 40 cents. $1.00 to nonmembers. Mimeographed.

Included in this study of the unique Ohio Conservancy Law are a history and digest of the law, maps, and discussions of what the districts have done about flood and erosion control and water conservation.

Post-War Growth and Planning for the Future of Long Island Lighting Company

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A paper presented before a meeting of the EEI Electrical Equipment Committee, Detroit, Mich., February 16, 1954

THE Long Island Lighting Co. is in a period of outstanding load growth. When measured by such normally accepted indices as increase in number of meters and increase in annual peak load, this company ranks with the leading four or five of the nation. Naturally, the problems associated with providing adequate and economical plant when and where required have been substantial. This report will outline how the management and personnel of the company have solved the problems thrust upon them.

The Long Island Lighting Co. provides electric and gas service to most of the area in Nassau and Suffolk Counties, which comprise Long Island east of the New York City limits. Incidentally, the company's operations also extend into New York City by serving an area known as the Rockaway Peninsula.

At the end of World War II, the nationwide phenomenon of migration from the cities resulted in an influx of population to Long Island, largely from New York City. During the last census decade, 1940 to 1950, the combined population of Nassau and Suffolk Counties increased from 604,103 in 1940 to 999,997 in 1950, an increase of 65.5 per cent. The combined population at the end of 1953 has been reliably estimated at 1,320,000, a three year increase of 32.0 per cent. The total growth of these two Long Island counties is exceeded by only two other counties in the nation, Dade County, Fla., and San Diego County, Calif.

This growth has transformed an area of quiet suburban-home communities, farm land, and summer resorts into an area that is now occupied by large-scale single-house developments, with attendant commercial and considerable light-industrial growth. Our company has averaged better than 30,000 new electric meters per year during the past five years, with most of the installations servicing single-family units. During the same period the peak load increased at an average rate of 19 per cent per year.

This introduction does not give an adequate picture of the detail problems that faced both management and employees, nor does it describe the joint teamwork that was required to meet the demands placed upon the company. The remainder of this report will describe the territory, its characteristics and people, the techniques of our planning; and the actual physical growth that brought capability into balance with demand.

The company serves an area of 1230 square miles, extending in general from the easterly boundary of Queens, New York City, to the eastern tip of Long Island, a distance of 100 miles. The island is approximately 20 miles wide, between the Atlantic Ocean, which is the southerly boundary, and Long Island Sound on the north. The western part of the territory is predominantly residential, while the eastern section is still agricultural, but the residential areas are slowly spreading eastward and absorbing the farm land. Throughout the territory small- and medium-sized diversified light-manufacturing plants are following and even preceding the development of residential areas. The population of this area exceeds that of Washington, D. C., as well as that in 14 of the United States. Fig. 1 is a map of the service area.

In recent years Long Island has been the location of one of the out-

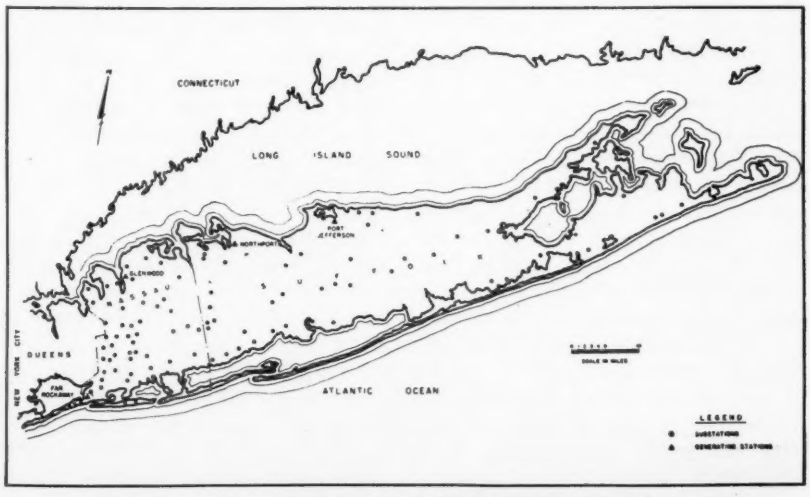


Fig. 1—Map of Long Island Lighting Co. Service Area, Showing Substations and Generating Stations

standing home building programs of our time. An average of 30,000 new homes have been built each year, mostly by large-scale developers.

One area, known as Levittown, is typical of this type of development, and a short description may help to point up some of the problems. In 1946 this area was almost entirely potato-farm land with a possible population of about 150. Five years later some 20,000 single-family homes, together with schools, churches, stores, and other commercial establishments, and about 60,000 people occupied the area. The latest population estimate of Levittown is 70,000. Fig. 2 is an aerial view of part of the Levittown development.

Fig. 2—Aerial View of Part of the Levittown Housing Development

The creation of these newer developments, adjacent to older and well established areas, resulted in many public relations problems for the company. In one, we had the conservative middle-aged family, well adjusted to suburban life and to the services of utilities in that type of community. On the other side we had the newly married couples, with growing families and a newly found pride in home ownership, plus a desire to avoid the appearances of the city, which they had just left, and yet to retain all the convenience of urban living. This brought about a delicate problem of maintaining balance between esthetic and engineering planning, and our success in that direction is evidenced by our excellent public relations.

Commercial activity has kept pace with residential growth. The long-established shopping centers have grown through expansion by local merchants, national chains, and the expansion or establishment of branches by most of the major New York City department stores. Likewise, the modern trend of constructing entirely new and integrated shopping centers adjacent to the new developments is developing rapidly.

Accompanying the rapid residential and commercial expansion has been the growth of a large number of small- to medium-sized diversified industries whose end products are dependent on skilled labor rather than on the processing of large amounts of raw material. These industries mushrooming throughout the territory with demands up to 1500 kw have added considerable load to available distribution and substation facilities.

Two of the prewar loads, farming and resort activities, while overshadowed by recent emphasis on residential, commercial, and industrial growth, actually have not suffered. Farm loads have increased because of development of large acreages of former waste land and more especially through irrigation and mechanization. Resort areas formerly experienced a very short summer season. Because of the automobile and greater leisure of the American public, these same areas, with few exceptions, now have substantial year-round loads.

The proximity to the ocean tempers the climate, so that the extremes of temperature encountered a few miles further inland are rare. However, the territory has experienced severe wind storms as evidenced by the hurricanes of 1938 and 1944 and the northeastern storm of 1950. These must be considered in the design of facilities and even more so in the planning of emergency restoration procedures to cope with aftermath storm damage. Although severe ice and sleet storms are relatively rare, they do occur, and must likewise be recognized in the design of transmission and distribution lines.

Serving the Load

In the six-year period from December, 1947, to December, 1953, the number of electric customers increased from 241,473 to 411,254 or 73 per cent. Average residential kilowatthour sales increased from 1187 to 2216 or 85 per cent. This is a rate 25 per cent faster than the national average. The net one-hour peak rose from 191,900 to 519,000 kw, which is 2.7 times its 1947 value.

Like other companies that experienced similar rapid and continuing post-war expansion, the Long Island Lighting Co. managed to serve the load. The inauguration and continuation of a large-scale construction program, which was tied into a very closely controlled schedule, made possible meeting the loads as they came on. Everyone in the industry went through the period of material shortage, labor difficulties, and back-breaking delays. Long Island was no exception, but, by close planning, coordination, and constant vigilance, the program suffered no material delay. This was accomplished by utilizing all the unused and sometimes unrealized capacity existing between nameplate ratings and actual load-carrying capability for the entire plant from boiler to pole-top transformer. The devices for achieving this result were many and ingenious.

To meet the demands, generating capacity was increased from 247,500 kw to 576,500 kw, presently installed, with an additional 280,000 kw expected capacity now under construction. At the same time we added 34 new substations to the system and enlarged 44 existing substations.

Transmission and distribution lines, featuring substantial mileages of oil-static pipe cable, were built and extended. Existing overhead transmission lines were rebuilt to higher voltages, while distribution voltage was established at 13.2 kv.

Operating and commercial facilities were not overlooked. A new central operating headquarters was established at Hicksville on a 63-acre plot

at a cost of $5,000,000. At this location we established the Electric Department headquarters, including system operations, emergency service, construction, maintenance, meters, maps and records, shops, stores, and transportation in a functionalized group of buildings. A 100,000-sq ft administration building will be started within the year to house engineering and other units associated with operations. Many new commercial offices were opened, including several erected by the company in new communities. Fig. 3 shows the Hicksville plant.

This program was completed during a period of acute shortage of manpower in all classifications, from skilled labor and mechanics up through the ranks of engineers to management. Company-operated and sponsored training programs played a large part in providing the required help as needed.

Planning for the Future

The company's planning functions have evolved through the period of stress into a very workable system.

Top planning is done by a Planning Committee made up of managers of the budget, commercial, engineering, rates, research, sales, and system engineering functions. This committee provides yearly and five-year forecasts of gas and electric sales and demands. Through subcommittees, population trends are predicted, sales and customer-use characteristics are forecast, geographic areas studied, and land-use maps prepared. Contacts are made with other utilities in the area, regional associations, and quasi-public bodies.

Second-level planning is done by the various engineering divisions. An Electric Planning Division is charged with determining necessity, size, type, location, and time schedule for the transmission, subtransmission, and substation program. A group in the Mechanical Engineering Division takes care of the power station planning, and a section in Distribution Engineering provides distribution plans.

Tools of Second-Level Planning

Effective planning to a large extent depends on the tools of planning. There are many, but from our experience the two important ones were (1) an a-c network analyzer and (2) adequate maps of facilities and territory.

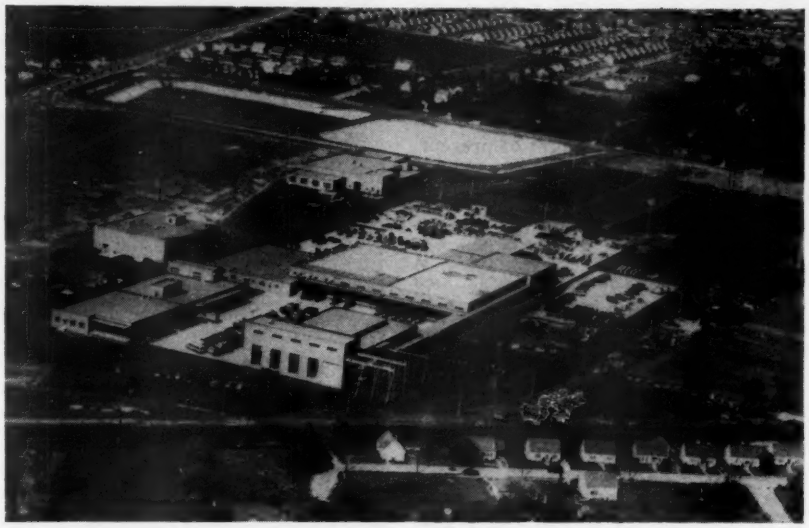


Fig. 3—The New Central Operating Headquarters Established at Hicksville

The need of analyzing the performance of the many schemes and plans proposed for the expansion of electric facilities highlighted the usefulness of an a-c network analyzer. The growing complexity of the system made virtually impossible the manual analyses of the past. Recourse to rented analyzers became more difficult as demand throughout the country grew. Consequently, it was decided to purchase an analyzer so that this major tool of planning would be available at all times.

A detailed description of this analyzer has been given in the technical press.[1] It is a 12-generator board with sufficient line and load units to duplicate the electric system even when it has expanded two or three times its present size. Fig. 4 shows the network analyzer installation.

On the basis of a year and a half of operating experience the results provided by the analyzer have been very satisfactory. Many more schemes are being considered than were possible a few years ago, and the possibilities of these schemes are analyzed for much longer periods in the future. It has

1. *AIEE Transactions*, "Communications and Electronics," May, 1953.

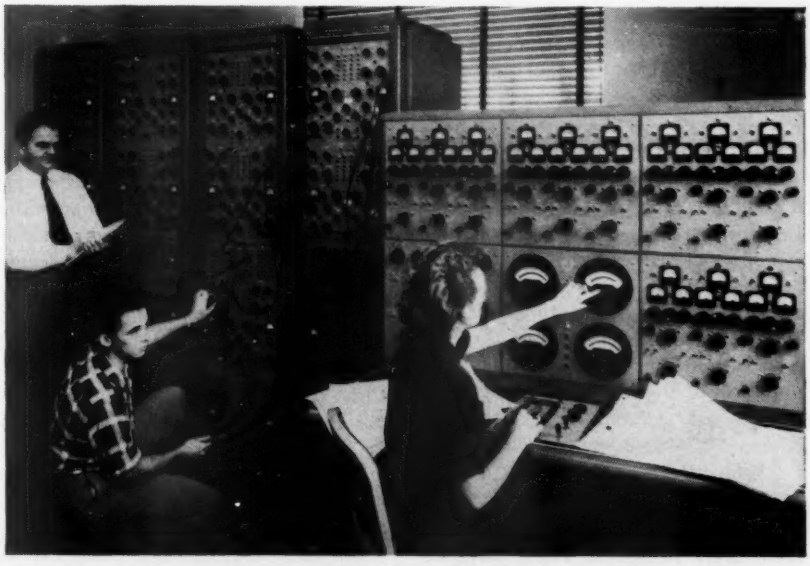


Fig. 4—The A-C Network Analyzer Installation

been observed that the potential value of proposed transmission varies from year to year or load level to load level. An accurate estimate of any particular scheme can only be obtained when it is considered in the light of present, near future, and distant future load levels.

The analyzer has permitted a better coordination between the timing of installation of equipment and load than was formerly possible. In some cases the data determined by analyzer studies made possible the deferment of major jobs and the resultant saving of capital expense for a year or more.

Mapping Program Established

A second important tool of planning is an adequate set of maps of transmission and distribution facilities and the geography of the territory. The prewar maps which were used by the several companies which later merged to form Long Island Lighting Co. were nonuniform in scale and size. In addition, the growth of the area had made not only our maps but available commercial street and road maps obsolete. To remedy these limitations, a complete new mapping program was established.

The aim of this program was to prepare accurate street and road maps on which present and future transmission and distribution systems could be recorded. After a thorough study of the accepted procedures, we decided to use aerial photography for determining the basic maps. This method resulted in very material savings in time and money.

The entire territory was flown at an altitude of 10,000 ft and some 800 photographs, each 9 in. by 9 in. and having a scale of 1 in. to 1600 ft, were taken. By photogrammetric methods 134 complete single-line road maps measuring 21 by 33 in. were drawn. From these basic maps, active maps for our gas and electric systems were prepared, using scales of 1 in. to 100 ft, 1 in. to 200 ft, 1 in. to 800 ft, and 1 in. to 2400 ft. The cost of the base maps came to about $250,000. The total cost of the completed maps showing the system facilities is expected to be about $750,000.

A valuable by-product of the mapping program has been the aerial photographs from which the basic maps were prepared. These have become important tools in determining suitable sites for future substations and plant facilities, as well as favorable routes for electric transmission lines.

The continued rapid growth has emphasized the need of planning for the future and coordinating immediate needs with future growth. New substations are designed so that transformer size can be doubled or even tripled. A few years ago the accepted standard interrupting capacity of distribution breakers was 150,000 kva. Today all new distribution breakers are rated either 250,000 kva for 4 kv or 500,000 kva for 13.8 kv. Experience has proven that the incremental cost of providing excess breaker capacity for the present is negligible compared to the future cost of wholesale breaker replacements.

Experience has likewise shown that substation sites must not only be large enough to accommodate what is required in the foreseeable future but must also have margin beyond that. With loads doubling in four or five years, the older substation sites that were spacious a few years ago are now overcrowded. It is not now unusual to obtain substation sites of several acres in which the initial equipment installed could be placed in a 150-ft by 150-ft plot. The need, either present or future, of providing landscaped buffer strips between the equipment and surroundings prevents full utilization of the site and makes necessary larger sites than otherwise would be required.

Transmission Rights-of-Way

In anticipation of further expansion of farm land or rural areas to residential areas, plans have been formulated to secure substation sites in these areas even though these sites may not be utilized for several years. The difficulties and cost of obtaining substation sites in developed areas or areas under development have forcibly demonstrated the need for this long-range action. The same applies to an even greater extent in the case of transmission rights-of-way. With these it becomes extremely difficult to obtain rights-of-way once development has started in an area. If rights-of-way become unavailable and if it is not possible to use public roads, the only alternative is underground cable. Since cable transmission costs five to six times the cost of overhead transmission, it is prudent to acquire transmission rights-of-way before they are required.

Available power plant sites are even more restricted and difficult to obtain and the need of providing space for future expansion more urgent. In the most recent site acquired, on which will be located the E. F. Barrett Plant, the initial unit scheduled for service in 1956 will have a rating of 125/156 mw. However, this site has space adequate to permit expansion to an ultimate of 1000 mw or twice our present peak load. Incidentally, this powerplant site was determined initially by a study of the aerial photographs and then confirmed by field inspection.

Generation

Establishment of additional generating capacity involves the most costly and time-consuming component of the system. Generating plants represent about 38 per cent of our total electric system investment and require about three to four years from inception to completion, as contrasted to one to two years for transmission and substation facilities. Furthermore, improvements in power generation have been more sweeping and rapid than in other branches. Consequently, planning of such facilities must be accurate and closely controlled in order to avoid deficiencies on one hand or excesses on the other.

In order to meet the load demands, the company undertook the construction of approximately 500 mw of new generating capacity to be placed on the line over a five-year period. Three of the units are duplicates, each with a capability of about 115 mw. The fourth is expected to have a capability of about 170 mw. Two of these machines have been installed and are in service, and construction is in progress on the other two.

Fig. 5 shows Glenwood Power Station No. 3, where the first machine was placed into operation in late 1952 and the third is expected to be in operation by late 1954. Far Rockaway Power Station No. 2 is the location of the second 115-mw machine, which went into service in late 1953. Fig. 6 shows an architectural rendering of the new E. F. Barrett Plant, where the fourth machine (170 mw) is expected in service in late 1956.

Local conditions have a marked effect on the type of equipment and

Fig. 5—Glenwood Power Station No. 3

construction used. Some of these conditions on Long Island are:

1. Moderate climate.
2. High fuel costs.
3. High labor costs.
4. High construction costs.
5. Decided limitation of available sites.
6. Proximity of all sites to residential areas.
7. Rapid growth.

These factors and others have influenced the general type of plant which is now being constructed.

As early as 1926, when a single-boiler, single-turbine installation was made at our Far Rockaway plant, it was recognized that a simple unit system would offer material savings in construction costs. This principle, along with a modified outdoor type of construction, was utilized fully in the first Port Jefferson unit placed in service in 1948 and has become the basic pattern for all later power station layouts.

Multiple Fuel-Burning Systems

The newer Long Island Lighting Co. power plants are the unit type with a single boiler, turbine, and transformer. They are designed in compact arrangement with modified outdoor housing and centralized instrumentation and control, so as to utilize operating labor at maximum efficiency. Multiple fuel-burning systems are provided, normally coal and oil, but with three fuels, coal, oil, and natural gas being used at the Glenwood Power Stations No. 2 and No. 3.

The moderate climate has made possible the extensive use of the outdoor type of construction. The Long Island Lighting Co. has been one of the pioneers in fostering outdoor design in the northeast. We started this trend in the 1948 installation at Port Jefferson, where a semi-outdoor boiler was installed. In subsequent plants, the turbine generator also has been placed outdoors and the partial enclosure around the boiler further reduced. It has been estimated that adoption of outdoor construction on our system has saved about $4.00 per kilowatt of installed capacity.[2] The design of the 1956 E. F. Barrett Plant, now under construction, will incorporate 10 years of ideas and experience gained in outdoor construction.

Fuel Stocks and Costs

The moderate climate permits the maintenance of fuel stock equivalent to 60 days of operation, since our harbors are not subject to long freeze-ups.

Relatively high fuel costs in this area have influenced the use of multiple fuels, in order that full advantage might be taken of even slight cost differentials. Likewise, the choice of conservatively high pressures and temperatures and the use of reheat in the last four units were all dictated by fuel cost analysis.

In order to keep operating labor costs to a reasonable minimum, extensive use has been made of instrumentation and automatic control. It is now standard practice to centralize all boiler, turbine, and switching operations, including supervisory control of certain remote substations, in a

2. ASME Symposium on the Design and Operation of Outdoor Power Plants.

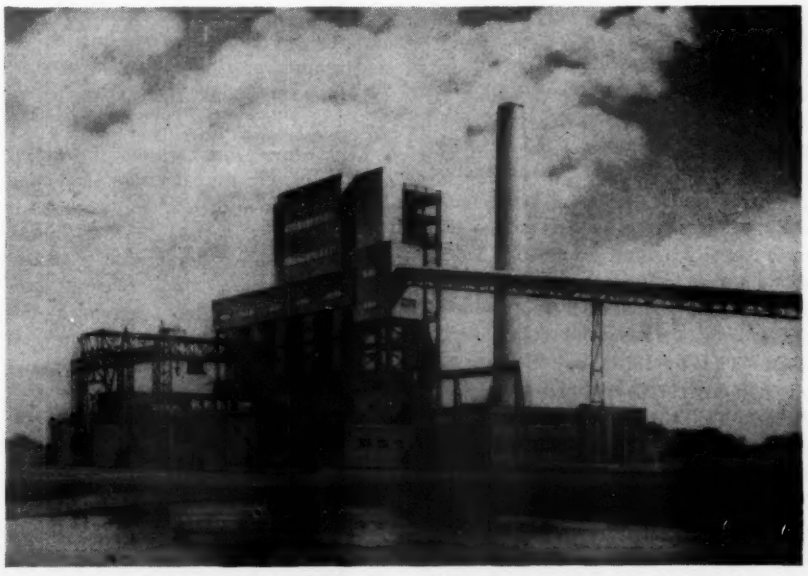


Fig. 6—Architectural Rendering of the New E. F. Barrett Plant

central control room. Similarly, such mechanical functions as soot blowing, ash removal and circulating water screen operations are also controlled from this same central point. The compact functional arrangement of the plants, which was dictated primarily by space considerations, also tends to minimize labor requirements.

High construction costs have influenced design in several ways. One has been the choice of fairly large-sized units in order to take advantage of lower unit costs. For instance, the first unit at the new Barrett station will be rated at 150 mw and is expected to deliver at 170 mw. Another method of reducing costs has been the duplication of units. The three 115-mw units (rated at 90/99 mw), Nos. 4 and 5 at Glenwood and No. 4 at Far Rockaway, are essentially duplicates. In this way we not only reduced design costs, but we were able to speed up installation time to help us meet the rapid load growth.

Few Potential Plant Sites

Long Island, while surrounded by deep water and many bays and fine harbors, offers very few potential power plant sites. This is one of the oldest settled areas in the country, and, as was typical in the early days, communities were established adjacent to every good harbor. Since that time these areas have become thickly settled and highly restricted. Consequently, every available site must be developed to its maximum. High land utilization has led to very compact design.

Proximity to residential areas has led to emphasis being placed upon reduction or elimination of all possible nuisances. The plants must be pleasing, though functional in appearance, and well landscaped to conceal yards and fuel-storage areas. Higher costs have been incurred to secure highly efficient dust collectors (above 95 per cent efficiency) and low noise-level transformers, fans, and other equipment. The modified outdoor station has demonstrated, contrary to preconceived ideas, that it is actually quieter than the conventionally totally enclosed plant. Stacks are high in order to dissipate products of combustion properly. Special precautions are taken to prevent contamination of the harbor waters, since bathing beaches and favorite fishing spots are in very close proximity.

High-Voltage Transmission

Another major problem facing the Long Island Lighting Co. was the necessity for expansion of its 69-kv transmission. Postwar growth emphasized the inadequacy of transmission to handle immediate load requirements, and the development boom seriously increased the difficulties in obtaining new rights-of-way.

In order to make the most effective use of existing 69-kv transmission, the following obvious measures were utilized:

1. Reduce transmitted wattless kva.
2. Improve reliability.
3. Increase conductor size where required and when possible.

The reduction of transmitted wattless kva was accomplished by installing a large number of capacitors throughout the system at load points. During the period 1947-1952, the added 130,000 kva of capacitors helped increase the peak load power factor from 79 to 92 per cent. System light load power factor now approaches unity.

Increased reliability of high-voltage transmission was provided by (1) improved sectionalization, (2) better lightning protection, and (3) greater use of supervisory control. To improve sectionalization, many 69-kv breakers were added to shorten exposures of long lines. Along with this a marked speed-up in fault-clearing time resulted from the use of high-speed distance or pilot-wire relaying on essential lines.

Lightning Protection

Lightning protection on the major portion of our high-voltage transmission is obtained by expulsion protector tubes installed in 1935-1937. Although these tubes have performed satisfactorily in the past, the increase in generating capacity has increased the 69-kv short-circuit duty far beyond the capacity of the tubes in many areas. In these areas the tubes will gradually be removed and the lightning performance of the lines improved by decreasing tower footing resistance either with deep ground rods or counterpoises and by raising the ground wire to provide a better shielding angle.

Supervisory control of strategic transmission-line breakers from centralized headquarters has provided an effective means of restoring temporary faulted transmission lines to service with a minimum of outage time. Experience has shown that the majority of transmission-line faults are temporary faults. The program is well under way and will continue until all major transmission breakers are under supervisory control.

With the reduction of reactive flow, the thermal ratings of conductors became the limiting factor in determining the capabilities of many transmission lines rather than voltage drop. This opened up the possibility of increasing conductor sizes to increase further the capacity of lines. This solution has been used only to a limited extent because of the difficulty of taking existing heavily loaded lines out of service. However, it will become of increasing importance in the future and will play a prominent part in long-range planning.

Increasing the Voltage

The possibility of increasing the voltage on existing transmission circuits has likewise been given serious consideration. This proposal is hampered, however, because the 69-kv transmission serves a dual role as subtransmission by supplying numerous 13.2- and 4-kv distribution substations. Plans are under consideration for increasing the voltage from 69- to 138-kv for a few long-distance transmission lines in which there are relatively few stepdown substations.

The rapid growth of the territory and the transition of the western part of the territory from rural to semi-urban and urban characteristics has made it extremely difficult to obtain overhead high-voltage transmission along public roads or private rights-of-way. Where possible, lines have been run along existing railroad rights-of-way. This, even with its drawbacks of interference with railroad communication and signal circuits and the difficulties of maintaining adequate line maintenance and repair, will, it is expected, be utilized to a larger extent in the future.

Faced with the difficulty, and in many cases the impossibility, of obtaining overhead rights-of-way, the company has found it necessary to use extensive underground high-voltage

cables. The following tabulation indicates the lengths of high-pressure oil-pipe cable installed during the past few years and planned for the immediate future:

Year	Conductor Size-Mcm	Voltage-Kv	Miles
1952	2,000	69	11.1
1952	1,000	69	4.7
1952	750	69	2.8
1954	2,000	69	10.0
1955	2,000	69	8.0
1955	1,500	138	6.5
1955	900	138	3.0
1956	1,500	138	11.0
1956	750	69	4.5

It is believed that in relation to its size the Long Island Lighting Co. will have the most extensive system of high-voltage underground cable in this country.

Effect on Long-Range Planning

The impact of an extensive high-voltage underground system on long-range planning is very marked. Foremost is the high transmission cost and the effect it has on system development. A ten mile run of 69-kv 2000-mcm cable now under construction will cost over $250,000 per mile. The low reactance of cable circuits is a significant factor in raising the system level of short-circuit duties, and full recognition must be made of this factor in the installation of present breakers to interrupt possible future short-circuit currents. In addition, the breakers must be capable of interrupting large amounts of charging kva with the minimum amount of restriking and possible resultant over-voltages. Recent advances in the art indicate that this problem has been solved. Other associated problems are the adequacy of lightning arresters and potential transformers on a cable terminal to handle the stored energy in the cable circuit.

Long runs of underground cable furnish an important source of charging kva. An 11-mile run of 2000-mcm 69-kv cable provides 22,000-23,000 reactive kva. To date this represents an asset, but as more cable is installed the cable-reactive kva may become a liability. It has a decided effect on the capacitor additions to other parts of the system and limits to a considerable degree the amount of unswitched capacitors that may be connected to substation buses or distribution lines. It is estimated that within four years the extensive runs of proposed 138-kv cable will increase the present light load power factor of 97 per cent lag to approximately 90 per cent lead.

Whether or not generators can be successfully operated at this leading power on our system must be determined. Two possible limitations are system transient stability and generator end-iron heating.

Comprehensive stability studies now under way in the a-c network analyzer will, it is believed, define the first limitation. To explore the second limitation, the 90/99-mw unit scheduled for operation in 1954 will be provided with thermocouples strategically located in the end-iron structure, so that correlation between end-iron heating and leading power-factor operation can be obtained. This data will be applicable to the two identical units now in service.

Should these studies and tests show that operation at 90 per cent leading power factor is not feasible, consideration will be given to dropping some of the 138-kv cable at light load. As a last resort it may be necessary to add high-voltage shunt reactors.

Subtransmission

Our 23-kv subtransmission was inadequate to handle the immediate load growth following the war. The problem of overcoming this inadequacy was approached from many angles; the more important methods used were to:

1. Reduce wattless kva.
2. Install regulating transformers at 23-kv sources.
3. Install additional transmission to subtransmission step-down substations.
4. Reduce load on subtransmission by stepping down directly from transmission to distribution voltage.
5. Raise subtransmission voltage from 23 to 33 kv in certain areas.
6. Obtain new rights-of-way for additional lines.

As with transmission, the installation of large amounts of capacitors at load points reduced the wattless kva transmitted and made the capabilities of the line more available for carrying real power. Along with this, voltage regulators were installed on many of the 23-kv step-down substations to increase line capabilities further. In some areas, when these two remedies failed to provide sufficient relief, new step-down transmission-subtransmission substations were built at strategic locations so that the lengths of 23-kv subtransmission lines were materially reduced.

Kva of Distribution Substations

An outstanding factor in easing the burden of inadequate subtransmission has been the increasing use of substations stepping down directly from existing 69-kv transmission voltage to distribution voltages of 4 or 13.2 kv, thereby eliminating the need of subtransmission. This has been particularly applicable with 13.2-kv distribution in which distribution lines can be extended considerable distances without meeting voltage drop limitations. The following table indicates the total kva of distribution substations in service during the five-year period 1947-1952 broken down into the amounts supplied from transmission and the amounts supplied from subtransmission:

Year	Total Kva Supplied from Transmission	Total Kva Supplied from Subtransmission
1947	21,500	198,202
1948	45,000	190,851
1949	72,000	195,551
1950	135,750	226,653
1951	163,200	286,837
1952	248,450	208,903
1953	298,450	366,570

Another solution to the problem has been the planned conversion of extensive 23-kv subtransmission to 33 kv in the heavily loaded western end of the system. New distribution substation transformers installed in this area were designed for operation initially at 23 kv with provisions in the windings to permit operation at 33 kv when the conversion was made. Subtransmission breakers, bus insulators, and switches have been purchased and designed for 33 kv in anticipation of this conversion. The general system plan of conversion has been to minimize the amount of new 23-kv equipment acquired and to absorb the 23-kv equipment released from conversion areas to absorb growth in those areas where existing 23-kv subtransmission will be adequate for a considerable time. These so-called "absorption areas" are essential in any long-range conversion plan to prevent the build-up of large stocks of nonuseable equipment on the system.

Additional rights-of-way for subtransmission lines have been acquired when possible and where needed. It is fully recognized that it will become increasingly difficult to obtain these as areas further develop. To date it has not been necessary to resort to long runs of underground subtransmission cable with the exception of relatively short runs entering or leaving a substation.

Distribution

The following table reflects the vast post-war expansion of distribution facilities. It gives the breakdown by distribution voltages of the total distribution substation transformer capacity in service, by years, during the period 1947-1957. The decreasing role of 2.4-kv distribution and the increased usage of 13.2-kv should be noted.

Year	Total 13.2 Kv (Kva)	Total 4 Kv (Kva)	Total 2.4 Kv (Kva)
1947	9,450	145,317	64,933
1948	17,500	153,984	64,266
1949	45,500	155,485	66,566
1950	87,000	204,337	71,066
1951	121,500	356,971	71,566
1952	195,000	294,737	67,616
1953	240,000	366,334	58,666

Conversion of 2.4-kv distribution to either 4 kv or 13.2 kv provided one method of reinforcing distribution to handle the post-war load increase. In the period 1947-1953 approximately 28,000 kva of 2.4-kv distribution substation capacity was converted to either 4 or 13.2 kv. Complete conversion of existing 2.4-kv distribution, particularly in the lightly loaded slow-growing areas of our territory, will probably not be completed for many years until the useful life of the equipment has been reached.

An important solution to the expansion problem was the adoption of 13.2 kv as a major distribution voltage. At the end of 1953, approximately 36 per cent of our load at the distribution level was supplied at 13.2 kv.

Economic studies backed up by considerable operating experience have indicated that it is not possible to use a rule-of-thumb method to establish arbitrarily zones or areas in which either 13.2- or 4-kv distribution should be used or extended. Each area or zone must be carefully investigated before a decision is reached. In addition to the immediate economic comparison, factors that must be considered include zoning problems, availability of feeder routes, distribution facilities of adjoining areas, retentions of 4-kv areas to absorb 4-kv equipment released by 4- to 13.2-kv conversion, nature of areas, and the possibility of future growth.

Zoning problems, particularly those involved in acquiring new substation sites, are in general relieved by utilization of 13.2-kv distribution. The longer distance served by 13.2 kv permits greater freedom in the choice of site than is realized with 4-kv distribution. Likewise, the greater distances served permits the distribution level load to be served with fewer substations. Since a 13.2-kv feeder can carry conservatively two to three times the load of a 4-kv feeder, fewer feeders are required to serve a given area, and this becomes an important factor where feeder routes are limited.

Adjoining distribution facilities must be considered in the final decision, since it is not desirable to retain isolated 13.2- or 4-kv areas that cannot be supported from other substations during emergencies. Moreover, it is necessary to retain certain 4-kv areas whose growth can utilize 4-kv equipment released from 4- to 13.2-kv conversion elsewhere.

A Definite Place

In serving long, lightly loaded rural lines where voltage drop is a limiting factor, 13.2-kv distribution has a definite place. Because of its greater load capabilities, it is well adapted to areas where heavy future growth is expected. Perhaps the outstanding example of the use of 13.2-kv distribution on our system was to supply Levittown, which in a period of five years grew from practically nothing to a population of 60,000.[3]

It has performed outstanding service in supplying both residential and industrial loads from the same circuit. Flicker problems, voltage regulation, and line-loading problems normally created by industrial loads when supplied from a 4160-v system are minor with higher voltage distribution. Had it not been for the development of the 13.2-kv distribution system, many of the new industrial loads may have required a separate 4160-v distribution circuit or a supply from a subtransmission voltage.

A valuable by-product of 13.2-kv distribution is the resultant improved appearance of distribution lines. The reduction of the number of circuits, the clean-cut appearance of modern 13.2-kv distribution construction, both 3-phase and single-phase, have, we believe, helped maintain our public relations.

Although it is planned that the two major distribution voltages will be 4.16 kv and 13.2 kv, certain areas in which the load density approaches that now reached in the metropolitan area will be supplied by 120/208-v secondary network. One highly concentrated commercial area is already supplied by such a network, the primary voltage of which is 13.2 kv.

Substations

It became evident that in the expansion of substation facilities consideration of public relations must go hand in hand with technical and engineering developments. In the latter, the experience of the industry was available as a background. In public relations, the problem was much more difficult, and its solution must carefully consider and recognize public opinion in our territory.

The post-war program in the expansion of our substation facilities may be summed up as follows: the installation of more substations, designs to provide enlarged and more reliable facilities, and more effective use of substation capability.

It was realized that not only must existing substation facilities be expanded but many new substation sites must be obtained. Lower unit costs favored the expansion, but the increasing difficulty of acquiring new sites indicated that failure to obtain them at an early date would pose a formidable block in the future. Consequently the two solutions have developed together.

The increase in size of substations is reflected in the trend toward larger distribution substation transformers. During the past seven years the common size of substation transformer banks has increased from 3,000 to 5,000, and now several 10,000-kva units are on order.

In 4-kv substations the expected pattern will be two 5,000-kva units. In 13.2-kv substations, which are largely supplied from 69-kv transmission, the expected pattern will be two 5000-kva transformers initially with provisions to increase the size in the future to

3. *Electrical World*, May 2, 1952.

Fig. 7—Landscaping on One of Long Island Lighting's Modern Substations

two 10,000-kva banks. In some special cases it may be necessary to provide space ultimately for four 10,000-kva units.

The first impact of large capacity substations was the increased short-circuit duty on associated switchgear. As previously noted, it has become our standard practice to specify 500,000-kva interrupting duty for 13.2-kv distribution breakers and 250,000 kva for 4-kv distribution breakers regardless of the initial location of these breakers. In addition, a five-year program of replacement of existing overstressed breakers is nearing completion.

Improving Reliability

Along with breakers of adequate interrupting duty the increasing use of factory-built unit substations with a minimum of exposed open bus work will, it is believed, be an important factor in improving the reliability of substations. Dual transmission sources are provided or planned for the great majority of substations so that first contingency transmission outages will not drop load. In those cases where permanent transmission faults would drop an entire substation, additional capacity is provided in adjacent substations so that the distribution load can be picked up. More sensitive and faster relaying has been incorporated in the protection of substations and their component parts.

In general, the loading on our substations is characterized by a short peak in early evening. Full advantage of the low daily load factor and ambient temperature are utilized in using transformer capabilities rather than transformer nameplate rating. Transformer capacities of 5000/6250 nameplate rating have a capabiiity on our system of approximately 8500 kva. In some unusual emergency cases loads exceeding 10,000 kva have been placed on a 5000/6250-kva bank with no apparent damaging effects.

To increase further the effective use of substation capacity, load power factor has been improved both by installing capacitors on distribution circuits and switched lumped capacitors on substation buses. Because of the need of absorbing large amounts of cable charging kva in the future, the great majority of such capacitors must be located on substation buses and must be capable of being switched.

An important factor in supplying rapidly growing load has been the use of 1500-kva single-circuit substation units. Since 1949, 15 such units have been purchased. They are particularly attractive because of their low initial cost and the fact that they can be moved if necessary without excessive expense. The principal use of these small units has been to provide a temporary source until larger permanent substations are available, but in some areas it is expected that they will continue to supply the local neighborhood for many years.

Minimizing Noise

The maintenance of good public relations requires that problems of noise and appearance of substations must be overcome. In a relatively few isolated areas these problems are not serious, but in the great majority of substations, particularly those on new sites, the problem is of major importance.

Past experience has indicated the need for obtaining transformers with a low noise level. With few exceptions, all our substation transformers are purchased with a noise level 6 to 9 db below the NEMA standard. In some locations where standard noise-level transformers were provided, it was necessary to construct complete acoustic barriers around the transformers. These barriers provide a reduction in noise of 10-11 db. In other locations it is probable that, even though quiet transformers are purchased, acoustic barriers will still be required. Whether the economic solution to the problem of noise reduction is to pay a premium for quiet transformers or to build acoustic sound barriers with their resultant maintenance remains to be determined.

Another approach to the substation noise problem has been, if possible and economically feasible, to purchase larger substation sites so that more space is available as a buffer strip between the transformer proper and present and possible future residences. Whenever possible substation sites are acquired in industrial zones (even though the land in industrial zones is usually more expensive than in residential zones), because possible noise is not usually objectionable to the neighboring commercial establishments.

Substation Appearance

The appearance of our modern substations has been improved considerably by extensive use of metalclad equipment as contrasted with the old open-type structures. Underground exits and in some cases underground entrances have greatly reduced the cluttered appearance of pole structures immediately adjacent to the substation.

The major improvement in appearance has been made by the careful selection of landscaping and shrubbery so that the substation will harmonize and blend in with its environs. Originally, landscape architects were engaged to assist in the planning and layout, but as we gained experience this important phase of the work was done by our own engineers. Fig. 7 is a photograph that effectively shows

(*Continued on page* 128)

The Credit Picture

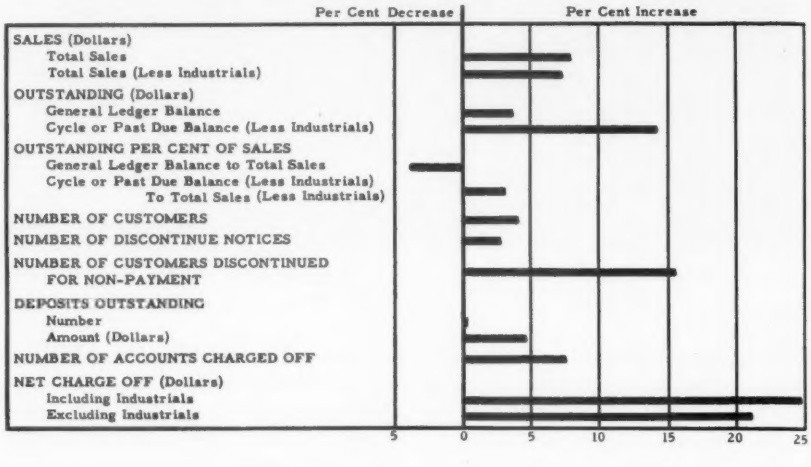
Results of Survey Conducted under Joint Supervision of the Credit and Collection Committees, EEI Accounting Division and AGA Accounting Section

THIS Credit Picture, which covers the last six months of 1953, has been compiled from data submitted by 78 utility companies. This is the largest number of companies to participate since the project was launched in 1948 and is indicative of the cooperation and sustained interest of the contributors.

All areas continue to report increases in sales, with the largest increases reflected in the western sections of the country. However, six companies, each located in different areas, report decreases in sales. The reductions range from less than 1 per cent to a maximum of slightly more than 9 per cent. Only one company reported a decline in sales for the first six months of 1953. The over-all increase in sales is still very encouraging but has declined in comparison to the increase trend for the same periods of 1951 and 1952.

Customer growth continues at approximately the same rate as during the past several years. The trivial increase in the number of security deposits is not commensurate with the greater number of customers, nor does it signify any concerted effort on the part of companies to protect themselves against losses through this medium. The amount represented in security deposits has materially increased, indicating that more substantial amounts are obtained to secure accounts, to cover larger average service bills, or to fortify against certain customers regarded as extreme credit risks.

CREDIT AND COLLECTION EXPERIENCE OF U. S. ELECTRIC AND GAS INDUSTRIES
July 1, 1953-December 31, 1953, compared with same period for 1952



Number of Discontinue Notices

It would appear that, despite larger cycle or past due balances, there is no general attempt being made to expedite payment by stepping up the number of discontinue notices sent to customers. It is interesting to note, however, that the general ledger balance per cent of outstanding to sales is reduced to a greater degree in the three districts that show the highest increase in the number of discontinuance notices sent, the number of service terminations, etc.

Charge offs, both in number and amount, continue to rise as they have done consistently since the Credit Picture was inaugurated. The upswing in customers and sales through these years naturally accounts for a considerable portion of our losses.

REFLECTION OF THE CREDIT AND COLLECTION EXPERIENCE OF UNITED STATES ELECTRIC AND GAS UTILITIES—JULY 1, 1953, TO DECEMBER 31, 1953

Per Cent—Increase or Decrease over Corresponding Period—1952

	New England	*Middle Atlantic*	*East North Central*	*West North Central*	*South Atlantic*	*East South Central*	*West South Central*	*Mountain States*	*Pacific States*	*United States Total*
Sales in Dollars:										
Total Sales	+ 6.0	+ 4.8	+ 6.9	+ 7.2	+ 9.7	+ 7.5	+10.9	+10.9	+12.2	+ 7.8
Total Sales Excluding Industrials	+ 7.7	+ 2.8	+ 7.7	+ 5.5	+ 7.9	+11.2	+10.2	+ 8.3	+ 5.9	+ 7.2
Outstanding in Dollars:										
General Ledger Balance	+ 5.3	+ 2.1	+ 4.2	+ 6.6	+ 5.4	+11.6	+ 8.7	+ 0.9	− 1.7	+ 3.6
Cycle or Past Due Balance (Excluding Industrials)	+14.2	+18.9	+ 9.9	+ 4.7	+13.4	+10.2	+16.9	+ 0.5	+22.3	+14.5
Outstanding Per Cent of Sales:										
General Ledger Balance to Total Sales	− 0.6	− 2.3	− 2.6	− 0.7	− 3.7	+ 3.8	− 2.3	− 9.0	−12.7	− 3.8
Cycle or Past Due Balance (Excluding Past Due Industrials) to Total Sales (Excluding Industrials)	0.0	+13.0	+ 2.9	− 3.2	+ 5.9	0.0	0.0	− 8.9	0.0	+ 2.9
Number of Customers	+ 1.8	+ 3.3	+ 3.5	+ 3.4	+ 5.1	+ 6.7	+ 3.6	+ 6.9	+ 4.5	+ 3.9
Number of Discontinue Notices	+ 6.3	+ 1.3	− 2.6	+ 1.7	+12.6	−13.7	+ 8.7	+16.0	+30.5	+ 2.6
Number of Customers Discontinued for Non-Payment	+13.6	− 0.9	+ 1.7	+18.8	+36.6	+ 3.2	+63.4	+54.9	+46.8	+15.4
Deposit Outstanding:										
Number	− 2.3	+ 5.3	+ 4.0	+ 4.9	−12.7	− 4.4	+17.8	+ 4.9	+ 3.0	+ 0.1
Amount (Dollars)	− 1.3	+ 6.9	− 3.9	− 3.0	+ 9.5	+ 6.5	+ 2.6	− 0.3	+11.2	+ 4.9
Number of Accounts Charged Off	+11.7	+ 0.5	+ 0.1	+20.0	+12.4	+14.1	− 6.1	+48.2	+16.0	+ 7.5
Net Charge Off in Dollars:										
Including Industrials	− 0.4	+15.6	+ 0.1	+18.2	+40.8	+62.6	+12.9	+35.9	+48.8	+24.5
Excluding Industrials	+12.8	+ 7.7	+ 9.3	+34.1	+39.7	+17.1	+ 2.8	+54.4	+40.7	+21.1
Companies Reporting	8	11	16	7	10	5	8	6	7	78

Electrical Equipment Committee Meeting

A. M. deBellis, *Chairman*

THE Electrical Equipment Committee held its 62nd meeting at the Sheraton-Cadillac Hotel in Detroit, Mich., on February 15-16, 1954, and was attended by approximately 95 members and guests. On Sunday, February 14, committee members were guests of The Detroit Edison Co. at a luncheon followed by an inspection tour of the company's St. Clair Power Plant.

The program consisted of presentations of papers, reports, and discussions under sponsorship of D. W. Taylor, Chairman of the System and Apparatus Troubles Division; C. C. Farrell, Chairman of the Apparatus and Design Division; H. E. Deardorff, Chairman of the System Engineering Division; and C. L. Derrick, Chairman of the Operation and Maintenance Division. In accordance with its regular procedure, the committee devoted most of the first day to a closed meeting for informal discussion of apparatus troubles and other appropriate subjects.

Whiting Plant Described

J. H. Foote presented a paper on the Justin R. Whiting Plant of Consumers Power Co., describing engineering features of the plant and the part it plays in the planned development of the company system. The plant is located at the extreme southeastern corner of the service area and, in addition to supplying the local area, feeds into the main transmission system, furnishing power to Jackson which is 65 miles to the northwest. Two units, each of 100-mw guaranteed gross output, were placed in operation in 1952, and a third unit of 125-mw guaranteed gross output was recently completed. Three interconnections, two of about 100-mw capacity each and a new connection of 150-mw capacity from the Whiting plant, are maintained with Detroit Edison to provide for parallel operation, the rendering of mutual assistance during emergencies, and economies in satisfying the power supply requirements of each system.

The Whiting plant follows conventional indoor construction and decentralized control. Panels for the boilers are located in the firing aisle, while turbine panels are located near the turbine end of the turbo-generators. Boiler-feed and house-service panels are arranged to form small operating centers located in the basement. Electrical controls for the output of the generating units and the 138-kv substation are located in a separate control room on the turbine floor and situated for a full view of the substation. The advantage of grouping operating controls in this manner is that personal observation of equipment is combined with instrument reading and control. Two 138-kv buses with motor operated disconnecting switches make it possible to connect any line or generator to either bus. Control cables in the substation area are carried in conduits supported overhead on the substation structure.

The cost of the plant and the step-up substation for 138-kv transmission, including site development and all construction costs, is expected to be $138 per kilowatthour of guaranteed gross output. This plant has been performing at an average annual heat rate of 9495 Btu per kilowatthour net generation delivered to the system.

W. Welch, Jr., and A. C. Sugden presented a paper entitled "Post-War Growth and Planning for the Future of Long Island Lighting Co." The company's service area, one of the fastest growing in the United States, has a population of one and a third million, which represents an increase of over a half million persons in the post-war period. Residential service accounts for about 50 per cent of the kilowatthour sales, the remainder going to commercial and light industrial enterprises. There is little heavy industry in the area.

Generating capacity as well as transmission and distribution facilities have been added to keep abreast of the increase in load. At Glenwood and Far Rockaway, semi-outdoor plants feature outdoor turbo-generators and unit construction with steam generators designed for burning coal, oil, and gas either separately or in any combination. Because of the congested area, more than 20 miles of 69-kv pipe-type cable has been placed in operation since 1951, and another ten miles is under construction. Mr. Welch described in some detail the new central operating headquarters at Hicksville, which features a central system-operations room embodying the latest design.

Post-War Development of Vepco

G. M. Tatum described the post-war planning and development of the Virginia Electric and Power Co. system. The central organization for system planning is a small group comprising the system planning section of the System Engineering Department. The size of the territory covered, 30,000 square miles, makes it impractical to concentrate all planning activities in the system office. The central group works with the engineering organization in the various districts in an advisory capacity, as well as studies the major distribution problems throughout the system. The planning section also works with the System Operating Department on planning for the transmission system and the location and capacity of new generating plants or additions to existing plants.

Increased loads since the war have necessitated construction of several new plants and additions to existing plants. Generating capacity additions have been located in the various load areas with the objective of minimizing transmission requirements. All of the post-war additions, however, have been connected directly into the transmission system rather than into a local distribution system, with the exception of the addition at Norfolk. Except in areas of concentrated load, subtransmission lines have not been paralleled by other subtransmission lines to meet load growth. Instead, transmission lines have been extended into the area or existing subtransmission converted to higher voltage. The transmission system is now doing double duty as high-voltage distribution.

Since the war, Vepco has extended rural lines so that at present electric service is now available practically anywhere in the company's territory. All of the post-war rural extensions are 7.2/12.5-kv or 7.6/13.2-kv 4-wire common neutral circuits, and conversions in small towns and suburban areas have followed this same pattern. In the urban areas most of the distribution has been converted to 4160 v from 2400 v, and it is planned to con-

tinue at this voltage where the load density is high.

C. L. Headly described relay protection used by Consolidated Gas, Electric Light and Power Co. of Baltimore. This system covers an area of nearly 2300 square miles, extending from the Pennsylvania line to 27 miles south of Annapolis. The company's electrical transmission system is comprised of a backbone of 33-kv tie circuits between generating stations and a 110-kv ring surrounding Baltimore at a radius of some ten miles. There are also ties with Pennsylvania Water and Power Co. to the south. The three interconnected systems operate as a unit, permitting economical or emergency interchange of power.

Generator Differential Relaying

The protection of the generators consists primarily of generator differential relaying. If the generator is connected to the system through a transformer, two sets of differential relays are used. One set covers the generator and leads to the transformer; the second set covers the generator and the transformer, including the transformer oil circuit breaker and consists of standard-type transformer differential relays, which are also wired to trip the oil circuit breaker and the field breaker. The generators are also provided with loss-of-field protection.

The 33-kv underground tie circuits are protected by high-speed (one-half cycle) overcurrent relays connected in a current balance differential circuit utilizing the current from each cable of a tie circuit. With this method of protection, the settings of the high-speed relays attached to the individual cables do not limit the loading of the ties. The 33-kv cables have been in service for more than 16 years, and during that time several faults have occurred. On each occasion the relays have cleared the faulted circuit within 8 to 10 cycles, and the operators have been able to switch out the bad cable at all points and return the good cables to service within 10 to 12 minutes.

On Tuesday afternoon the committee chairman announced formation of the new System Planning Subcommittee of the Electrical Equipment Committee. He said that R. G. Meyerand had been appointed Chairman and R. G. Hooke, Vice Chairman. The new subcommittee will consist of 20 members and be essentially a working group studying system planning methods and following the scope outlined by the Engineering Division General Committee. There will be eight members from the Electrical Equipment Committee, two members each from the Prime Movers and the Transmission and Distribution Committees, and eight members who are not presently on any of the EEI engineering committees.

J. S. Newbold described the experience of the Carolina Power and Light Co. in operating and maintaining outdoor generating stations. From a system-wide standpoint, there are unique problems in planning the annual maintenance schedule for outdoor turbo-generators in that expected weather conditions during different seasons of the year should be taken into consideration; in North Carolina the spring and early summer seasons are satisfactory with regard to both system load and weather. It is estimated that inspection outage time is extended approximately 5 to 10 per cent to protect and clean parts normally protected by the building in an indoor plant.

From a maintenance standpoint, the outstanding difference between an indoor and an outdoor plant is in making repairs to outdoor equipment that requires special antifreeze protection. The boiler feed-water piping and all lines above ¾-in. diameter, which can either be drained or through which a flow can be maintained at all times, are unprotected except for regular heat insulation. Other piping requiring antifreeze protection is supplied with heat by resistance wire and strip heaters. In performing maintenance work on lines and valves protected in this manner, the antifreeze protection must be removed and replaced very carefully. This work entails additional maintenance man-hours, and efforts are being directed towards simplification on new designs.

Mr. Newbold informed the committee that both operators and maintenance men who have transferred from indoor to outdoor plants were unanimous in their preference for the outdoor plant.

R. H. Mertz described radio noise tests carried on by The Detroit Edison Co. in shop and field to minimize customer complaints and equipment failure. RIV (Radio Influence Voltage) measurements are a part of the regular tests made on 34.5-kv transformer and oil circuit breaker bushings. RIV measurements are also a part of the regular acceptance tests of insulators for use on overhead lines and station buses. Modified RIV measurements are a part of the routine check of distribution types of arresters. Radio patrol is a standard procedure on Detroit Edison's overhead lines system. Conditions that commonly cause interference are burned insulator pins, defective insulators, loose connectors, loose tie wires, and contact of conductor with tree branches. If a condition of this type is not corrected promptly, it may result in equipment failure.

Starting the Astoria Plant

The last paper, sponsored by R. M. Pennypacker of the Operation and Maintenance Division, was presented by R. H. Freyburg and entitled "Starting of the New Astoria Plant of the Consolidated Edison Co. of New York, Inc. — Operating Experience." The Astoria Electric Generating Station is the first new station to be built in the Consolidated Edison system since 1926. The initial portion of the station houses two 180-mw, 1800-psi, 1000-F/1000-F reheat cross-compound turbo-generators. Construction contracts were awarded to outside contractors for various sections of the work. The company provided over-all coordination and inspection services; all testing of an electrical nature was performed by company forces or under their immediate supervision.

Mr. Freyburg described a number of mechanical troubles experienced during starting but commented that the lack of any large number of failures of electrical apparatus speaks well for the electrical design and installation.

Harris Barber of the Apparatus and Design Division sponsored a review of the "Proposed Standard for Power Circuit Breaker Control" by Oscar Bauham, who is a member of the AEIC Committee on Electric Switching and Switchgear. Mr. Bauham explained the details of the proposed standard and asked that anyone desiring more information or wishing to discuss the standard more fully correspond with him directly.

The next meeting of the committee will be held at the Edgewater Beach Hotel, Chicago, Ill., May 3-4, 1954.

Personals

Walter H. Sammis, President of the Institute and President of Ohio Edison Co., has been named a winner of the 1954 Egleston Medal, Columbia University's highest award "for distinguished engineering achievement." The announcement was made by P. M. Landolt, President of the Columbia Engineering School Alumni Association, sponsor of the Egleston Medals.

The award will be made to Mr. Sammis, a Columbia graduate, at the annual Egleston dinner, to be held in the Waldorf-Astoria Hotel in New York, N. Y., on April 14.

Donald C. Luce, Vice President in Charge of Combined Operations, Public Service Electric and Gas Co., has been elected President to succeed **George H. Blake,** and **Lyle McDonald,** Vice President in Charge of Finance, has been named Chairman of the Board.

Mr. Luce, who joined the company as a cadet engineer in 1924 following his graduation from Lehigh University, held various assignments with the company before he was named chief engineer at Kearny Electric Generating Station in 1935. Since then, his positions, successively, have been general superintendent of electric generation, general manager of the electric department, vice president in charge of electric operations, and vice president in charge of combined operations. A member of the Institute's Board of Directors and former chairman of the EEI Codes and Standards Committee, Mr. Luce is chairman of the Light's Diamond Jubilee Committee.

Mr. McDonald, who has been with the company for 38 years, has been a director and a member of the executive committee since 1945. From his first position as an accountant, Mr. McDonald rose to the position of comptroller in 1937 and vice president in 1944. He became vice president in charge of finance in 1948.

A veteran of 44-year's service with the company, Mr. Blake will continue as a director. The New York University graduate practiced law with a Jersey City firm for two years before he joined Public Service as a trial attorney in 1910. He was made assistant general solicitor in 1921 and two years later became general solicitor. In 1934 he was named a director of the company and the next year was made a member of the board's executive committee. For the two years prior to his election as president in 1945, he served as executive vice president.

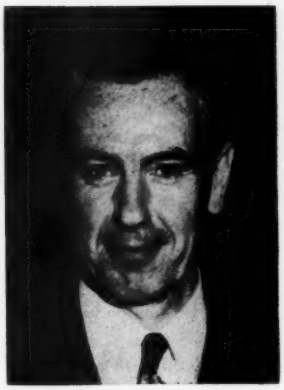
William C. MacInnes, Vice President of both Tampa Electric Co. and Stone & Webster Service Corp., has been elected President of Tampa Electric, succeeding the late **Francis J. Gannon.**

Born in Canada, Mr. MacInnes attended Massachusetts Institute of Technology and graduated as an electrical engineer in 1927. For the next three years he served with Savannah Electric and Power Co. and from 1930 to 1935 worked as assistant to the president at Sierra Pacific Power Co. He was then employed by Stone & Webster Service Corp. in New York until 1937 when he became president of West Coast Power Co. In 1941 he was appointed vice president of Stone & Webster Service in New York, taking on the added duties of vice president of Tampa Electric in 1945. He has resigned from his post with Stone & Webster to assume his new position.

MR. SAMMIS

MR. LUCE

MR. MCDONALD



MR. MACINNES

Arthur H. Kehoe, Vice President, Consolidated Edison Co. of New York, Inc., has retired after 43 years of service to the electric industry. A former vice president of the Institute, to which he devoted his talents for many years, he was a member of its Board of Directors and Chairman of its Codes and Standards Committee at the time of his retirement.

Mr. Kehoe, an inventor and the developer of the automatic alternating current network, was recognized for his outstanding contributions to the industry in 1944, when he received the Lamme Medal of the American Institute of Electrical Engineers. As a result of his work, trends in metering were changed, and radical alterations were made in the design of substations and substation equipment. Within his own company he has been an acknowledged leader in the development of managerial talent.

He joined United Electric Light and Power Co. in 1911 as an assistant engineer following his graduation from the University of Vermont, which in later years bestowed upon him an honorary degree of Doctor of Engineering. When he joined the company, he undertook to remove the

obstacles preventing an alternating current network from being a dependable and economic reality. Within 11 years, United installed the first a-c network system. In 1921 Mr. Kehoe became United's electrical engineer and 11 years later was named vice president of New York Edison and United Companies. He has been a vice president of Consolidated Edison since 1936.

C. A. Hummel, Vice President of Interstate Power Co., has been named Executive Vice President, filling the vacancy made by **M. L. Kapp's** election to the presidency of the Iowa company.

Following his graduation from the University of Minnesota in 1926, Mr. Hummel started working in the company's Drafting Department. He later served as construction engineer and field engineer before moving in 1931 to Tulsa, Okla., where he served Central States Power & Light Corp. as a district engineer and later as chief engineer. In 1939 he rejoined Interstate Power as chief engineer and was elected to the board of directors that same year. He became vice president in 1949.

Raymond A. Gibson, Vice President, The Hartford Electric Light Co., has been elected Executive Vice President, and **H. B. Carey, Jr.,** General Counsel, has been named Vice President.

An electrical engineering graduate of Rensselaer Polytechnic Institute, Mr. Gibson joined the company's Sales Department in 1923. Among the positions which he has filled for the company are advertising manager, commercial manager, assistant to the vice president, and sales manager. For the past year, he has been a member of the company's board of directors.

Mr. Carey is a graduate of the Yale Law School and is a partner in a Hartford law firm.

Engineering personnel changes at American Gas and Electric Service Corp. have been announced as follows:

V. M. Marquis, Vice President of System Operation and Planning, has been made Vice President and Assistant to the President. He has been with American Gas and Electric since 1928, except for a period when he served with the War Production Board during World War II. He served as system planning and operating engineer prior to becoming vice president in 1950.

S. N. Fiala, Mechanical Engineer, has been made Chief Engineer. **F. A. Lane,** Electrical Engineer, has been made Deputy Chief Engineer. **F. M. Porter,** Electrical Equipment Section Head, has been made Electrical Engineer.

H. P. St. Clair, System Planning Engineer, has become Planning and Operating Engineering Manager. **T. T. Frankenberg,** Assistant Mechanical Engineer, has been appointed Mechanical Engineer. His former position has been filled by **G. W. Bice,** previously Steam Generation Section Head.

J. H. Kinghorn, Assistant Electrical Engineer, has been made Deputy Electrical Engineer. **H. F. Hoebel,** Senior Engineer of the Electrical Engineering Department, has assumed the post of Assistant Electrical Engineer. **J. E. Geue,** Plant Consultant, has been appointed Operating Manager of Production.

R. W. Hurd, Assistant Vice President, and **D. M. Kammert,** Comptroller, both of West Penn Power Co., have been elected Vice Presidents.

Mr. Hurd, a graduate of Carnegie Institute of Technology, joined West Penn Power in 1927. Between 1928 and 1948 he served successively as assistant district manager at Butler and New Kensington and as district manager at Clarion, Scottdale, Ridgway, and Charleroi. In 1948 he became Western Division manager at Washington, moving later to Kittanning as Northern Division manager. He went to the company's headquarters at Pittsburgh in 1952 as assistant to the president and was named assistant vice president in 1953.

Mr. Kammert, who was also elected to the board of directors, will continue as comptroller. A 1932 graduate of the University of Illinois, he held various positions with Illinois Power & Light Co. and other subsidiaries of North American Co. for ten years before joining The West Penn Electric Co. (Inc.), parent company of West Penn Power, as assistant to the comptroller. In 1945 he took on the added duties of assistant secretary and assistant treasurer of West Penn Power. In 1948 he was named assistant comptroller of The West Penn Electric Co., serving there until 1951 when he joined West Penn Power's headquarters staff as comptroller.

In another appointment at West Penn Power, **R. G. MacDonald,** Assistant Vice President, was named to the newly created post of Manager of General Services.

With the company since 1931, Mr. MacDonald has served successively as assistant division line superintendent, assistant personnel director, assistant line superintendent, district manager at Bellefonte, and Keystone Division manager. He became assistant to the vice president in 1952 and assistant vice president in 1953.

Miss **Emma Koch,** Assistant Director of Home Economics, West Penn Power Co., has been named Home Economics Director to succeed Mrs. **Avis Broadhurst,** who recently retired.

A 25-year veteran with West Penn, Miss Koch has been in the Home Economics Department since it was formed in 1930. Mrs. Broadhurst, who was associated with the company for a 15-year period, was home economics director for the past 11 years.

H. K. Breckenridge, Vice President, West Penn Power Co., has resigned to join Ebasco Services Inc. His first assignment with the consulting firm will be as general manager of a project to provide a unified power system for Greece.

Mr. Breckenridge began his career with the West Penn Electric System in 1925 as a transportation engineer with American Water Works and Electric Co. in New York. Other positions he has held with the system include those of transportation engineer and manager of bus operations, West Penn Railways; assistant to the president, West Penn Power and West Penn Railways; personnel director, both companies; and member of the Board of Directors, both companies.

Two executives of Pennsylvania Electric Co. and Metropolitan Edison Co. have been given added duties. Both companies are part of the General Public Utilities system.

T. O. McQuiston, Vice President and General Sales Manager of Metropolitan Edison, has received addi-

tional responsibilities through his appointment to System Residential and Commercial Sales Manager of Penelec. **W. C. Sontum,** Engineering Vice President and Director of Pennsylvania Electric, has taken on the added duties of Engineering Coordinator of Penelec and Metropolitan Edison.

Mr. McQuiston first worked with Philadelphia Co. in Pittsburgh, Pa., in 1926. Later, with Duquesne Light Co., he held various sales positions before becoming residential sales manager in 1942. He moved to Metropolitan Edison in 1950 as sales manager, becoming vice president and general sales manager later that same year.

A native of Pittsburgh, Pa., Mr. Sontum started his electric industry career with West Penn Power Co. in 1914. In 1927 he became superintendent of electrical equipment for Penn Public Service Corp., predecessor of Pennsylvania Electric. He was named superintendent of operations of Penelec in 1937, operating manager in 1938, and a member of the board in 1941. In 1942 he became vice president in charge of operations and two years later was appointed engineering vice president.

Fred J. Gunther, Manager of Operations at Kansas City Power and Light Co., has been elected Vice President. In the electric industry as an operations engineer for 40 years, Mr. Gunther has been with the company since 1947.

In other managerial changes, **C. Myron Lytle,** Manager of Engineering, was named Manager of System Operations; **C. C. Cornelius,** Superintendent of Overhead, was named Manager of Construction and Maintenance; and **A. J. Nicholson,** Engineer, was named to succeed Mr. Lytle as Manager of Engineering.

Rob Roy Macleod, Commercial Manager of Niagara Mohawk Power Co.'s Western Division, has been elected Commercial Vice President. He will have headquarters in Buffalo, N. Y.

A graduate of Boston University, Mr. Macleod worked in the newspaper field before starting his electric industry career. He has been with the Niagara Mohawk system and its predecessor companies since 1926, when he joined the Publicity Department of the Buffalo, Niagara, & Eastern Power Corp. In 1928 he became manager of public relations there.

In 1933 he was named vice president and general manager of Bradford Electric Co., becoming president two years later. When this system company was sold in 1936, he went to Niagara Falls Power Co. as executive vice president and director and, in that same year, was also elected president and director of Niagara Junction Railway Co. He later moved to Buffalo as a vice president of the system's Western Division companies. When Niagara Mohawk Power was formed in 1950 he was placed in charge of its commercial operations in western New York.

Harry M. Schelden, Lehigh Division Manager, Pennsylvania Power & Light Co., has been named Vice President.

Before joining the company as a traveling auditor in 1921, Mr. Schelden worked with Bethlehem Steel, while an engineering student at Lehigh University, and with American Steel & Wire Co. In 1926 he was named general auditor for Harrisburg Light & Power Co., then a subsidiary of PP&L. When that company became the Harrisburg Division of PP&L in 1928, he was named division auditor. He was appointed manager of the Harrisburg District in 1946 and was transferred from that position to manager of the Field Practices Section of the company's general offices in Allentown in 1952. In 1953 he became Lehigh Division Manager.

Four new Vice Presidents have been elected by Gulf States Utilities Co. They are **Henry V. Faber,** Treasurer; **William H. Gieseke,** Secretary; **John J. Morrison,** Assistant to the President; and **L. V. Smith,** Assistant Secretary and Assistant Treasurer.

Mr. Faber, who left Savannah Electric and Power Co. in 1934 to assume the position of Treasurer for Gulf States, will continue to fill his present duties.

After beginning his career with Houston Electric Co., Mr. Gieseke served as a staff accountant with Gulf States' parent company, Engineers Public Service Co. He has been Secretary of the Beaumont, Texas, firm since it became an independent company.

Another former employee of Savannah Electric and Power and of Engineers Public Service is Mr. Morrison. He served as utility analyst for ten years with the parent company before assuming the duties of assistant to the president of Gulf States when it became independent in 1947.

Mr. Smith first was associated with Gulf States in 1927 as assistant treasurer. Three years later, he joined Baton Rouge Electric Co. as treasurer, a position which he also held for a one-year period with Western Public Service Co. In 1938, when the Baton Rouge company was consolidated with Gulf States, Mr. Smith assumed the duties of assistant treasurer and assistant secretary, which he will continue to perform.

J. Lawrence McNealey, Assistant Vice President, Columbus and Southern Ohio Electric Co., has been named Vice President in Charge of Operations to succeed **Morgan L. Evans,** retired after 47 years' service with the company and its predecessors.

Mr. McNealey joined the company in 1923 as a meter reader while still in high school. After technical training at Case Institute of Technology he worked as a lineman, line superintendent, and electrical engineer, successively. In 1936 he took on the additional duties of safety director for the Southern Division, later moving to Columbus, Ohio, as assistant purchasing agent. He next served as assistant manager of the Southern District for four years before becoming assistant vice president in 1950.

Mr. Evans, affiliated with the company since 1906, first worked for one of its predecessors, Columbus Railway & Light Co., as a clerk. He was made general superintendent in 1929 and vice president in charge of operations in 1930.

Recent organizational changes announced by Potomac Electric Power Co. include the following:

George C. McCabe, Assistant to the Vice President in Charge of Operations, has been appointed Manager of the Electric System. A veteran of 20-

year's service with Pepco, Mr. McCabe will assume full responsibility for the operation of the Substation, Distribution, Meter, Motor Transportation, Building Operations, and Power Dispatching departments.

The Assistant to the manager of the Electric System will be **Dorsey F. Hughes,** Engineer of Distribution. Mr. Hughes, who is a graduate of Union College and has been associated with the company for 24 years, will be succeeded in his former position by **Terrill Coons,** Assistant Engineer of Distribution.

L. W. Cadwallader, who was General Superintendent in the Generating Department, is now Mechanical Engineer.

Wilford J. Robinson, Plant Engineer at the Benning Station, has been named Superintendent of Steam Production, and will be responsible for the operation of the company's three generating stations, including efficiency testing and the Roving Mechanical Maintenance Force. He is a graduate of Purdue University.

J. E. Cushman, Assistant to the Vice President of Utah Power & Light Co., has been appointed Commercial Manager.

A native of Salt Lake City, Mr. Cushman has been with UP&L since 1912. He served successively as groundman, salesman, troubleman and lineman, and district representative before becoming division superintendent of lines and service crews at Rexburg, Ida., in 1929. Ten years later he filled the same post at Ogden, Utah, and returned in 1941 to Rexburg as division manager. He became Preston, Ida., division manager in 1945 and assistant to the vice president in 1952.

Miss Rosamond L. Carlson, Director of Home Service, Northern States Power Co. (Wis.), has been appointed Assistant Director of Home Service of Northern States Power Co. (Minn.)

Miss Carlson joined Northern States Power Co. at Eau Claire, Wis., in 1935, the year of her graduation from Stout Institute, and was transferred to Winona, Minn., a year later as home service supervisor. In 1940 she went to La Crosse, Wis., in the same capacity and in 1946 was transferred back to Eau Claire as home service director of the Wisconsin company, the position she held until her promotion and transfer to NSP of Minnesota.

Mildred Morrissey has been elected Assistant Secretary of Northern States Power Co. A veteran of 29 years' service with the company, Miss Morrissey is the first woman to hold an official position with Northern States.

Employee Selection

(*Continued from page* 109)

better position than anyone else to explain fully to the applicant the job requirements. Before making the final selection, the clerical supervisor can actually show the applicant the type of work he would be doing, the work location, and other details. In addition to giving the supervisor an opportunity to size up the applicant, it gives the applicant an opportunity to size up his prospective boss, the people he would be working with, the work location, and the type of work. Regardless of the qualifications of any applicant, his success as an employee depends largely on a harmonious relationship with his first boss and on his satisfaction with his work environment. The supervisor will be less critical and will work more closely with employees he has actually selected.

Careful selection of clerical employees can have a profound effect upon the operating efficiency of an office and can in turn play an important part in controlling clerical costs. If well-qualified and willing workers are continually being brought into an organization to meet current needs, clerical work performance will tend to remain at a high level, assuming conditions of efficient procedure and adequate supervision.

The reporting companies have found this to be fundamental. They uniformly believe that a well-planned and administered selection procedure can materially aid in maintaining a high standard of clerical performance and, thus, effectively help in controlling clerical costs.

Planning for Long Island Lighting Company

(*Continued from page* 121)

landscaping on one of our modern substations.

Our substation landscaping experience has indicated that it is advisable to procure larger substation sites than formerly so that adequate space is available for protective landscaping. Adequate protection is just as important in the winter months as it is in the summer months, so basic shrubbery employed in landscaping must be relatively expensive evergreens with the emphasis placed on hemlocks. Furthermore, planting must be selected with a view to minimizing future maintenance costs. Experience has indicated that the cost of landscaping a typical 3000- or 5000-kva substation ranges from $2000 to $5000. Maintenance of the landscaping is on the order of $1000 per year per substation.

It has been found that preliminary discussion with local civic groups has been very effective in providing landscaping that meets with the approval of the public. In some cases local civic groups have assisted us in the detailed landscaping design, with the result that our joint efforts have obtained acclaim in local newspapers. In many cases local town boards require us to submit a landscaping plan before a building permit is granted.

In conclusion, a broad review of the successful expansion of our electrical facilities to meet post-war growth indicates that the essential elements were:

1. Continued maintenance of excellent public relations.
2. Coordination of planning for immediate needs with long-range planning.
3. Willingness to try new ideas and developments which lead to lower cost and improved relations.

Above all, and without which the effort would have failed, is the high morale and excellent teamwork of our employees.

EDISON ELECTRIC INSTITUTE OFFICERS AND COMMITTEES

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HAROLD QUINTON, *Vice President*.....Southern California Edison Co., Los Angeles, Calif.
H. S. BENNION, *Vice President and Managing Director*....420 Lexington Avenue, New York, N. Y.
H. S. SUTTON, *Treasurer*.....Consolidated Edison Co. of New York, Inc., New York, N. Y.
A. B. MORGAN, *Secretary and Assistant Managing Director*..420 Lexington Avenue, New York, N. Y.

BOARD OF DIRECTORS

(Terms Expiring 1954)

ERNEST R. ACKER.....Central Hudson Gas & Electric Corp., Poughkeepsie, N. Y.
HARLLEE BRANCH, JR.....Georgia Power Co., Atlanta, Ga.
ROBERT P. BRIGGS.....Consumers Power Co., Jackson, Mich.
H. J. CADWELL.....Western Massachusetts Electric Co., Greenfield, Mass.
STUART COOPER.....Delaware Power & Light Co., Wilmington, Del.
D. C. LUCE.....Public Service Electric and Gas Co., Newark, N. J.
M. S. LUTHRINGER.....Central Illinois Public Service Co., Springfield, Ill.
W. W. LYNCH.....Texas Power & Light Co., Dallas, Tex.
C. E. OAKES.....Pennsylvania Power & Light Co., Allentown, Pa.
HAROLD QUINTON.....Southern California Edison Co., Los Angeles, Calif.
T. E. ROACH.....Idaho Power Co., Boise, Ida.
H. B. SARGENT.....Arizona Public Service Co., Phoenix, Ariz.
L. M. SMITH.....Alabama Power Co., Birmingham, Ala.
McGREGOR SMITH.....Florida Power & Light Co., Miami, Fla.
D. E. WASHBURN.....Boston Edison Co., Boston, Mass.

(Terms Expiring 1955)

A. D. BARNEY.....The Hartford Electric Light Co., Hartford, Conn.
G. M. GADSBY.....Utah Power & Light Co., Salt Lake City, Utah
C. B. DELAFIELD.....Consolidated Edison Co. of New York, Inc., New York, N. Y.
ALLEN S. KING.....Northern States Power Co., Minneapolis, Minn.
EARLE J. MACHOLD.....Niagara Mohawk Power Corp., Syracuse, N. Y.
PAUL B. McKEE.....Pacific Power and Light Co., Portland, Ore.
S. C. McMEEKIN.....South Carolina Electric and Gas Co., Columbia, S. C.
GROVER C. NEFF.....Wisconsin Power and Light Co., Madison, Wis.
P. H. POWERS.....West Penn Power Co., Pittsburgh, Pa.
R. G. RINCLIFFE.....Philadelphia Electric Co., Philadelphia, Pa.
WALTER H. SAMMIS.....Ohio Edison Co., Akron, Ohio
C. V. SORENSON.....Indiana & Michigan Electric Co., Ft. Wayne, Ind.
N. R. SUTHERLAND.....Pacific Gas and Electric Co., San Francisco, Calif.
J. B. THOMAS.....Texas Electric Service Co., Ft. Worth, Tex.
ALLEN VAN WYCK.....Illinois Power Co., Decatur, Ill.

(Terms Expiring 1956)

D. E. ACKERS.....Kansas Power and Light Co., Topeka, Kan.
W. C. BECKJORD.....The Cincinnati Gas & Electric Co., Cincinnati, Ohio
JOSEPH M. BELL, JR.....New York State Electric and Gas Corp., Binghamton, N. Y.
WALKER L. CISLER.....The Detroit Edison Co., Detroit, Mich.
B. L. ENGLAND.....Atlantic City Electric Co., Atlantic City, N. J.
J. G. HOLTZCLAW.....Virginia Electric and Power Co., Richmond, Va.
R. K. LANE.....Public Service Co. of Oklahoma, Tulsa, Okla.
P. H. McCANCE.....Duquesne Light Co., Pittsburgh, Pa.
R. E. MOODY.....Union Electric Co. of Missouri, St. Louis, Mo.
HARRY B. MUNSELL.....Kansas City Power and Light Co., Kansas City, Mo.
O. TITUS.....Pennsylvania Electric Co., Johnstown, Pa.
W. O. TURNER.....Louisiana Power and Light Co., New Orleans, La.
G. W. VANDERZEE.....Wisconsin Electric Power Co., Milwaukee, Wis.
WILLIAM WEBSTER.....New England Electric System, Boston, Mass.
FRANK M. WILKES.....Southwestern Gas and Electric Co., Shreveport, La.

Executive Committee

E. A. Acker, A. D. Barney, Harllee Branch, Jr., W. L. Cisler, D. C. Luce, C. E. Oakes, P. H. Powers, R. G. Rincliffe.

EDISON ELECTRIC INSTITUTE OFFICERS AND COMMITTEES

ADVISORY COMMITTEE (1953-1954)

D. C. BARNES.....Virginia Electric and Power Co., Charlottesville, Va.
E. F. BARRETT.....Long Island Lighting Co., Mineola, N. Y.
J. B. BLACK.....Pacific Gas and Electric Co., San Francisco, Calif.
G. H. BLAKE.....Public Service Electric and Gas Co., Newark, N. J.
PRENTISS M. BROWN.....The Detroit Edison Co., Detroit, Mich.
CURTIS E. CALDER.....Electric Bond and Share Co., New York, N. Y.
THOMAS G. DIGNAN....Boston Edison Co., Boston, Mass.
EDGAR H. DIXON.....Middle South Utilities, Inc., New York, N. Y.
WILLIS GALE....Commonwealth Edison Co., Chicago, Ill.
R. H. KNOWLTON..The Connecticut Light and Power Co., Berlin, Conn.
E. L. LINDSETH..The Cleveland Electric Illuminating Co., Cleveland, Ohio
H. P. LIVERSIDGE.....Philadelphia Electric Co., Philadelphia, Pa.
J. E. LOISEAU.....Public Service Co. of Colorado, Denver, Colo.
J. W. MCAFEE.....Union Electric Co. of Missouri, St. Louis, Mo.
C. B. MCMANUS....The Southern Co., Inc., Atlanta, Ga.
I. L. MOORE..New England Electric System, Boston, Mass.
W. C. MULLENDORE.....Southern California Edison Co., Los Angeles, Calif.
KINSEY M. ROBINSON, The Washington Water Power Co., Spokane, Wash.
WILLIAM SCHMIDT, JR....Consolidated Gas Electric Light and Power Co. of Baltimore, Baltimore, Md.
H. R. SEARING, Consolidated Edison Co. of New York, Inc., New York, N. Y.
PHILIP SPORN...American Gas and Electric Service Corp., New York, N. Y.
L. V. SUTTON.....Carolina Power & Light Co. Raleigh, N. C.
E. S. THOMPSON.....The West Penn Electric Co. (Inc.), New York, N. Y.
J. R. WHITING.....Consumers Power Co., Jackson, Mich.

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Coordinator of Customer Activities, J. GORDON ROSS.....Rochester Gas and Electric Corp., Rochester, N. Y.
Customer Accounting, G. F. HIGGINS.....The Detroit Edison Co., Detroit, Mich.
Customer Collections, T. C. EICKMEYER.....The Dayton Power and Light Co., Dayton, Ohio
Customer Relations, C. J. BERNER.....Wisconsin Electric Power Co., Milwaukee, Wis.
Coordinator of General Activities, E. E. ROLL.....The Detroit Edison Co., Detroit, Mich.
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General Accounting, A. R. ST. BERNARD.....The Cleveland Electric Illuminating Co., Cleveland, Ohio
Internal Auditing, L. D. BRUMIT.....Florida Power Corp., St. Petersburg, Fla.
Plant Accounting and Records, C. W. KELSEY.....New York State Electric and Gas Corp., Ithaca, N. Y.
Taxation Accounting, S. J. SCHIML.....The Dayton Power and Light Co., Dayton, Ohio

COMMERCIAL

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Commercial Sales Section, S. S. SANSBURY.....Union Electric Co. of Missouri, St. Louis, Mo.
Farm Section, E. D. SMITH.....The Dayton Power and Light Co., Dayton, Ohio
Industrial Power and Heating Section, MAXWELL COLE.....Philadelphia Electric Co., Philadelphia, Pa.
Residential Section, R. J. MILLER.....The Cleveland Electric Illuminating Co., Cleveland, Ohio
Special Service Section, J. M. STEDMAN.....Pennsylvania Power & Light Co., Allentown, Pa.

ENGINEERING

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Electrical Equipment, A. M. DEBELLIS.....Consolidated Edison Co. of New York, Inc., New York, N. Y.
Hydraulic Power, P. M. HESS.....Pennsylvania Water & Power Co., Lancaster, Pa.
Meter and Service, C. V. MOREY.....Consolidated Edison Co. of New York, Inc., New York, N. Y.
Prime Movers, W. L. CHADWICK.....Southern California Edison Co., Los Angeles, Calif.
Transmission and Distribution, J. W. ANDERSON.....Philadelphia Electric Co., Philadelphia, Pa.

GENERAL

Accident Prevention, R. P. DOUGLAS.....The Detroit Edison Co., Detroit, Mich.
Area Development, W. I. DOLBEARE.....Virginia Electric and Power Co., Richmond, Va.
Atomic Power, EDGAR H. DIXON.....Middle South Utilities, Inc., New York, N. Y.
Codes and Standards.....To be Appointed
Electric Power Survey, WALKER L. CISLER.....The Detroit Edison Co., Detroit, Mich.
Financing and Investor Relations, R. N. BENJAMIN.....Stone & Webster Service Corp., New York, N. Y.
Industrial Relations, F. R. RAUCH.....The Cincinnati Gas & Electric Co., Cincinnati, Ohio
Insurance, W. O. RANDLETT.....Virginia Electric and Power Co., Richmond, Va.
Legal, T. JUSTIN MOORE.....Virginia Electric and Power Co., Richmond, Va.
Membership, E. S. THOMPSON.....The West Penn Electric Co. (Inc.), New York, N. Y.
Prize Awards, HARRY RESTOFSKI.....West Penn Power Co., Pittsburgh, Pa.
Purchasing and Stores, C. H. ZURNIEDEN.....Philadelphia Electric Co., Philadelphia, Pa.
Rate Research, I. L. CRAIG.....Philadelphia Electric Co., Philadelphia, Pa.
Research Advisory, M. S. LUTHRINGER.....Central Illinois Public Service Co., Springfield, Ill.
Research Projects, STANLEY STOKES.....Union Electric Co. of Missouri, St. Louis, Mo.
Statistical, W. W. GODARD.....The Cleveland Electric Illuminating Co., Cleveland, Ohio
Transportation, D. K. WILSON.....Niagara Mohawk Power Corp., Albany, N. Y.